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# Legislative Environmental Impact Statement
# Strategic Arms Reduction Treaty (START)

December 1991

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Cooperating Agency: Department of the Navy

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## COVER SHEET
## LEGISLATIVE ENVIRONMENTAL IMPACT STATEMENT
## STRATEGIC ARMS REDUCTION TREATY (START)

a. Responsible Agency: Department of the Air Force on behalf of the Department of Defense

b. Proposed Action: US Senate's consent to ratify the Strategic Arms Reduction Treaty (START)

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d. Designation: Legislative Environmental Impact Statement

e. Abstract: The United States Government proposes to establish a treaty between the US and USSR to limit the number of deployed, strategic offensive arms. This treaty, known as the Strategic Arms Reduction Treaty (START), requires ratification by the US Senate before implementation. Pending ratification, the Treaty would limit the number of Intercontinental Ballistic Missiles (ICBMs) and their launchers, Submarine Launched Ballistic Missiles (SLBMs) and their launchers, heavy bombers, and the total number of warheads of ICBMs, SLBMs, and heavy bomber armaments. The proposed action would impose an overall limit of 1,600 to the number of heavy bombers, SLBMs and their launchers, and ICBMs and their launchers, and a limit of 6,000 to the number of warheads and heavy bomber armaments. Treaty-related actions could involve Air Force, Navy, Army, and other agencies, approximately 20 states; and residents within and near over 30 communities. The Legislative Environmental Impact Statement (LEIS), prepared by the Air Force as Lead Agency on behalf of the Department of Defense, describes and compares the potential environmental effects of both the proposed action (Treaty ratification) and the no action alternative (Treaty non-ratification) at potentially affected locations. These locations include heavy bomber deployment bases; ICBM deployment bases; heavy bomber storage, conversion, and elimination facilities; and ICBM storage, conversion, and elimination facilities. The no action alternative assumes that strategic weapon deployments and activities would continue in accordance with the current Defense Plan, and in response to continuing assessment of mission needs. Under the proposed action, some or all heavy bomber and ICBM deployment bases may experience reduced air and noise emissions, hazardous waste generation, risk to human health and safety, and employment. This could also occur under the no action alternative, but over a different timeframe than required by the Treaty. Environmental effects at heavy bomber and ICBM storage, conversion, or elimination facilities may increase as a result of activities associated with strategic arms reduction. No difference in environmental effects related to SLBM system programs will occur under the proposed action because current U.S. plans for storage, conversion, retirement, and elimination of SLBM systems are consistant with Treaty reduction requirements.

# EXECUTIVE SUMMARY

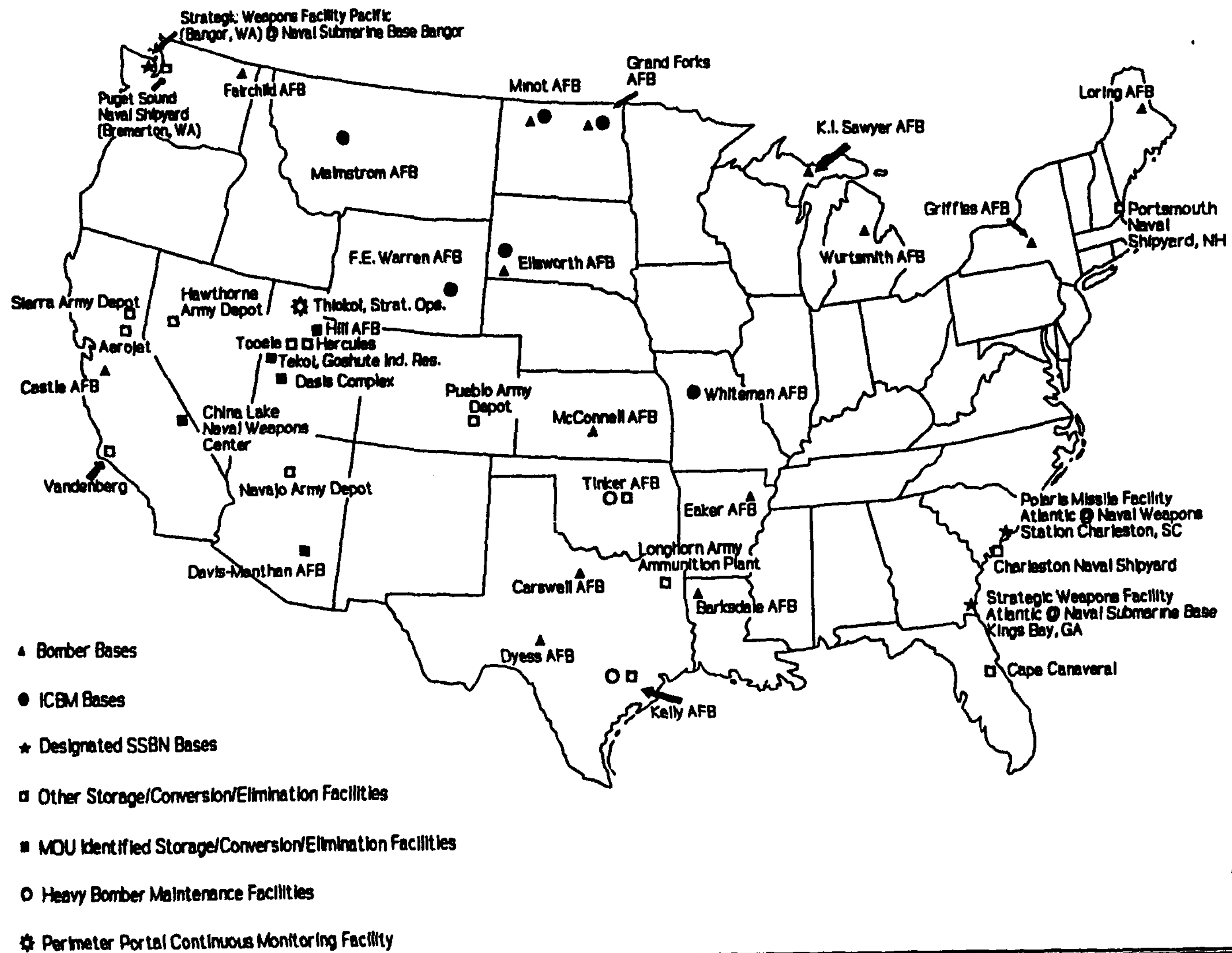
The Strategic Arms Reduction Treaty (START) is an agreement between the United States (US) and the Union of Soviet Socialist Republics (USSR) on the reduction and limitation of Intercontinental Ballistic Missiles (ICBM) and their launchers, Submarine Launched Ballistic Missiles (SLBM) and their launchers, heavy bombers, and the total number of warheads of ICBMs, SLBMs, and heavy bomber armaments. The proposed action evaluated in this Legislative Environmental Impact Statement (LEIS) is the US Senate's consent to ratify the Treaty. The purpose of the proposed action is to enable the US and the USSR to begin a mutually verifiable program to reduce the number of deployed, strategic offensive arms.

The LEIS describes the environmental effects of both the proposed action (Treaty ratification) and the no action alternative (Treaty non-ratification). The Senate's option of recommending modification to the Treaty would constitute non-ratification. Therefore, rather than attempting to predict possible proposed modifications, and the impacts of such unforeseeable modifications, this document treats any modifications recommended by the Senate as a form of the no action alternative. The proposed action would reduce and limit the number of deployed US strategic offensive arms and limit the number of non-deployed ICBMs for mobile launchers of ICBMs. The Treaty would impose an overall limit of 1,600 to the number of deployed heavy bombers, deployed SLBMs and their launchers, and deployed ICBMs and their launchers (also referred to as silo launchers), and a limit of 6,000 to the number of warheads attributed to deployed ICBMs, deployed SLBMs, and deployed heavy bombers. Additionally, the Treaty would impose an overall limit of 250 to the aggregate number of non-deployed ICBMs for mobile launchers of ICBMs.

The no action alternative assumes that strategic weapon deployments and activities would continue in accordance with the current Defense Plan, and in response to continuing assessment of mission needs. Routine operations, flights, sea patrols, and training would continue, as would maintenance and refits. Strategic arms modernization, conversion, retirement, transportation, and storage activities would also continue, as would proposed realignment, base closures, and reductions in force. The baseline against which environmental effects are to be assessed, the no action alternative, therefore, is unusually complex and dynamic.

The potential consequences of implementing START are also complex, and the LEIS serves as an important communication medium to the numerous government agencies, communities, businesses, and individuals that may be affected by the Treaty. As shown in Figure E-1, Treaty-related actions could involve Air Force, Navy, Army, and other agencies; approximately 20 states; and residents within and near over 30 communities. Therefore, the immediate thrust of this LEIS is to serve as the initial environmental input to the legislative decision on ratification of START, and focuses on the environmental issues bearing on the implementation of the Treaty. The document provides the best available answers to the question, "What environmental impacts could occur as a result of the Treaty?"

## Figure E-1
## Potential Implementation Locations



The specifics of Treaty implementation are not fully defined in the Treaty and will be the subject of future discussion. Therefore, this document provides only a generic description and environmental evaluation of the proposed action. Future decisions associated with Treaty implementation will be analyzed in subsequent site-specific, detailed environmental documents that are prepared and presented as input to those future decisions.

Table E-1 compares the proposed action with the no action alternative for all potentially affected US strategic offensive arms. The table summarizes current and no action activities involving heavy bombers, ICBMs and associated launchers, SLBMs and associated launchers, and nuclear warheads, with potential changes in operations anticipated with the proposed Treaty ratification action. For some strategic offensive weapon systems, operations and activities under the proposed action and no action alternatives will remain essentially unchanged. For others, the only change resulting from the proposed action may be in the level of weapon system activities, i.e., increased offensive strategic arms elimination, conversion, and storage.

Table E-2 compares the environmental effects associated with the changes in strategic offensive arms programs presented in Table E-1 under Treaty ratification, versus the effects of the no action alternative, which essentially serves as the baseline for this environmental impact analysis. The analysis considers environmental effects, both at the deployment bases and for strategic offensive arms storage, conversion or elimination facilities. Under the proposed action, some or all heavy bomber and ICBM deployment bases may experience reduced air and noise emissions, hazardous waste generation, risk to human health and safety, and employment, while the environmental effects at storage, conversion, or elimination facilities may increase. These impacts could also occur under the no action alternative, but over a different timeframe than required by the Treaty. No difference in environmental effects related to SLBM system programs will occur under the proposed action because current US plans for storage, conversion, retirement, and elimination of SLBM systems are consistent with Treaty reduction requirements.

Chapter 1 of this document describes the purpose and need for the proposed action, and the function and scope of the LEIS document in accordance with National Environmental Policy Act (NEPA) and other applicable requirements. Chapter 2 describes the proposed action and alternatives, outlines the no action alternative, summarizes the programmatic impacts, and compares possible implementation methods. A description of the natural and man-made environment likely to be affected by one or more of the alternative methods for implementing the proposed action is presented in Chapter 3, while Chapter 4 discusses the potential impacts of ratification and implementation of the Treaty. The references, glossary of terms, and support documentation for the LEIS analysis are presented in Chapter 5 and in the appendices. A list of abbreviations and acronyms follows the List of Tables in the Table of Contents.

**Table E-1**
**Summary Comparison of the Proposed Action with the No Action Alternative**

| | | | | |
|---|---|---|---|---|
| **No Action Alternative: Non-Ratification of START** | | | | |
| **Heavy Bombers** | **ICBMs and Associated Launchers** | | **SLBMs and Associated Launchers** | |
| | **ICBM Launchers (Silos)** | **ICBMs** | **SLBM Launchers (SSBNs)** | **SLBMs** |
| • Routine bomber operations, training, and maintenance<br>• Continue proposed force modernization<br>• Deactivation, storage, and retirement of obsolete bombers | • Continued operation and maintenance<br>• Possible upgrading and modernization of facilities<br>• Deactivation of obsolete launchers | • Continued modernization & replacement with new missile systems<br>• Possible deactivation, storage, & elimination of obsolete missile systems<br>• Continued ICBM removal & transport to maintenance facilities<br>• Warheads - Continued transportation, dismantlement, and fissionable material recycling from warheads | • On-going maintenance<br>• Elimination or conversion of submarines with C3 missiles and non-Ohio class sub-marines with C4 missiles<br>• Deployment of Ohio Class submarines with D5 missiles, including those initially configured with C4 missiles | • Cease deployment of C3 and C4 missiles<br>• Continued deployment of D5 missiles<br>• Warheads - Continued transportation, dismantlement, & fissionable material recycling from warheads |
| **Proposed Action: Ratification of START** | | | | |
| **Heavy Bombers** | **ICBMs and Associated Launchers** | | **SLBMs and Associated Launchers** | |
| | **ICBM Launchers (Silos)** | **ICBMs** | **SLBM Launchers (SSBNs)** | **SLBMs** |
| Increased:<br>• Storage, conversion, & elimination of heavy bombers<br>• Possible construction of additional facilities to support proposed action | • Elimination of some launchers<br>• Modification of launch control facility to negate launch capability | Increased:<br>• Storage, conversion, & elimination<br>• Possible construction of additional missile storage buildings<br>• Potential construction of additional facilities to support proposed action<br>• Warheads - Plan and implement larger scale program of warhead transportation, dismantlement, & recycling | • Same as No Action Alternative<br>• US can meet Treaty reduction requirements under current conversion, retirement, and elimination plans | • Same as No Action Alternative<br>• Navy can meet Treaty reduction requirements under current conversion, retirement, and elimination plans<br>• Warheads - Continued transportation, dismantlement, & fissionable material recycling from warheads |

## Table E-2
## Summary Comparison of the Environmental Effects of the No Action (NA) Alternative and the Proposed Action (PA)

| Heavy Bombers | | ICBMs and Associated Launchers | | | | SLBMs and Associated Launchers | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | ICBM Launchers (Silos) | | ICBMs | | SLBM Launchers (SSBNs) | | SLBMs | |
| NA | PA | NA | PA | NA | PA | NA | PA | NA | PA |
| **DEPLOYMENT BASES** | | | | | | | | | |
| Continuing:<br>• Air & noise emissions<br>• Hazardous waste generation & disposal<br>• Potential fuel spill contamination of soil & ground water<br>• Potential risk to human health & safety<br>• Potential force structure change, realignment, & base closures with associated employment fluctuations | Long-term:<br>• Reduction of noise & air emissions<br>• Reduction in hazardous waste generation & disposal from maintenance of reduced number of aircraft<br>• Potential decreased employment<br>• Reduction in risks to human health & safety from reduced air traffic & handling of hazardous wastes | Continuing:<br>• Potential soil contamination from herbicide use<br>• Employment from operation & maintenance | Long-term:<br>• Reduction in soil contamination from herbicide use<br>• Reduction in operational & maintenance employment<br>• Potential impacts from silo elimination including disruption to geology, soils & aquifers | Continuing:<br>• Potential risk to human health & safety from removal & transport to maintenance facility<br>• Potential force structure change, realignment & base closures with associated employment fluctuations<br>• Warheads - Potential risk to human health & safety from removal, transport & maintenance | Long-term:<br>• Reduction in potential transportation/ handling risks to human health & safety<br>• Reduction in potential risk to human health & safety from operations & maintenance activities<br>• Warheads - Reduced potential risk to human health & safety resulting from reduced transportation & maintenance activities | Continuing:<br>• Impacts on air quality, noise, & transportation<br>• Employment from operation & maintenance | Same as No Action | Continuing:<br>• Potential risk to human health & safety from removal & transport to maintenance facility<br>• Warheads - Potential risk to human health & safety from removal, transport & maintenance | Same as No Action |
| **STORAGE, CONVERSION, AND ELIMINATION FACILITIES** | | | | | | | | | |
| Continuing:<br>• Employment from operational support<br>• Hazardous waste generation & disposal<br>• Air & noise emissions | Short-term:<br>• Increase in operational employment<br>• Increase in hazardous waste generation & disposal<br>• Increase in air & noise emissions | See Deployment Bases | See Deployment Bases | Continuing:<br>• Potential elimination of obsolete ICBMs by static fire, open burn & launch R&D resulting in air & noise emissions<br>• Employment from operational support<br>• Storage & maintenance of back-up ICBM inventory<br>• Warheads - Potential risk to human health & safety from removal, transport, handling & recycling warheads | Short-term:<br>• Potential increase in elimination rate of ICBM boosters by static fire, open burn & launch R&D resulting in air & noise emissions<br>• Potential increase in employment for operations, maintenance & construction activities<br>• Long-term increase in storage & maintenance of ICBM boosters & components<br>• Warheads - Increased risk from dismantling & recycling increased number of warheads & potential capacity problem from handling & transporting additional warheads | Continuing:<br>• Potential human health & safety risk to hazardous materials exposure from elimination activities<br>• Industrial safety risks | Same as No Action | Continuing:<br>• Potential elimination of obsolete SLBM boosters by static fire, open burn & launch R&D resulting in air & noise emissions<br>• Employment from operational support<br>• Storage & maintenance of back-up SLBM inventory<br>• Warheads - Potential risk to human health & safety from removal, transport & maintenance | Same as No Action |

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## ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| AAP | Army Ammunition Plant |
| ACHP | Advisory Council on Historic Preservation |
| AEDC | Arnold Engineering Development Center |
| AF | Air Force |
| AFB | Air Force Base |
| AFLC | Air Force Logistics Command |
| AHPA | Archeological and Historic Preservation Act |
| AICUZ | Air Installation Compatible Use Zone |
| AIRFA | American Indian Religious Freedom Act |
| $Al_2O_3$ | Aluminum Oxide |
| ALC | Air Logistics Center |
| AMARC | Aerospace Maintenance and Regeneration Center |
| AMCCOM | Armament, Munitions and Chemical Command |
| AP | Ammonium Perchlorate |
| ARPA | Archaeological Resources Protection Act |
| ASRM | Advanced Solid Rocket Motor |
| $Ca(OCl)_2$ | Calcium Hypochlorite |
| CDNL | C-Weighted Day-Night Levels |
| CEQ | Council on Environmental Quality |
| CERCLA | Comprehensive Environmental Response, Compensation and Liability Act |
| CERL | Construction Engineering Research Laboratory |
| CFR | Code of Federal Regulations |
| $Cl_2$ | Chlorine |
| CO | Carbon Monoxide |
| $CO_2$ | Carbon Dioxide |
| dB | Decibels |
| dBA | Decibels, A-weighted scale |
| DNL | Day/Night Noise Level |
| DOD | Department of Defense |
| DOE | Department of Energy |
| DOT | Department of Transportation |
| EA | Environmental Assessment |
| EAC | Economic Adjustment Committee |
| EDE | El Dorado Engineering, Inc. |
| EIFS | Economic Impact Forcast System |
| EIS | Environmental Impact Statement |
| EPA | Environmental Protection Agency |
| EPCRA | Emergency Planning and Community Right-to Know Act |
| ETIS | Environmental Technical Information System |

| | |
|---|---|
| °F | Fahrenheit |
| FBM | Fleet Ballistic Missile |
| Ft | Feet |
| | |
| GNP | Gross National Product |
| | |
| $H_2$ | Hydrogen |
| $H_2O$ | Water |
| HC | Hydrocarbons |
| HCl | Hydrogen Chloride |
| HCN | Hydrogen Cyanide |
| HMTA | Hazardous Materials Transportation Act |
| Hr | Hour |
| | |
| ICBM | Intercontinental Ballistic Missile |
| INF | Intermediate-Range Nuclear Forces |
| IRP | Installation Restoration Program |
| ISCST | Industrial Source Complex, Short-Term Model |
| | |
| kg | Kilograms |
| km | Kilometer |
| | |
| LAI | LABAT-ANDERSON, Incorporated |
| lbs | Pounds |
| LCC | Launch Control Center |
| LCF | Launch Control Facility |
| Ldn | Day-Night Noise Level |
| LEIS | Legislative Environmental Impact Statement |
| LF | Launch Facility |
| | |
| m | Meters |
| MCL | Maximum Contaminant Level |
| $\mu g/m^3$ | Micrograms Per Cubic Meter |
| $\mu g$ | Micrograms |
| mg | Milligram |
| MM | Minuteman |
| MOU | Memorandum of Understanding |
| | |
| $N_2$ | Nitrogen |
| NAAQS | National Ambient Air Quality Standards |
| NASA | National Aeronautics and Space Administration |
| NEPA | National Environmental Policy Act |
| NESHAP | National Emission Standards for Hazardous Air Pollutants |
| $NH_4^+$ | Ammonia |
| NHPA | National Historic Preservation Act |
| NIOSH | National Institute for Occupational Safety and Health |
| $NO_2$ | Nitrogen Dioxide |

| | |
|---|---|
| $NO_x$ | Nitrogen Oxides |
| NPDES | National Pollutant Discharge Elimination System |
| NRHP | National Register of Historic Preservation |
| $O_3$ | Ozone |
| OEA | Office of Economic Adjustment |
| OSHA | Occupational Safety and Health Administration |
| PCAD | Products of Combustion/Atmospheric Dispersion Model |
| PCB | Polychlorinated Biphenyl |
| PM | Particulate Matter |
| $PM_{10}$ | Particle Matter Equal to or Smaller than 10 Micrometers in Diameter |
| PPCM | Perimeter Portal Continuous Monitoring |
| ppm | Part Per Million |
| PSD | Prevention of Significant Deterioration |
| RCRA | Resource Conservation and Recovery Act |
| ROI | Region of Influence |
| RTV | Rational Threshold Value |
| s | Second |
| SAC | Strategic Air Command |
| SARA | Superfund Amendments and Reauthorization Act |
| SDI | Strategic Defense Initiative |
| SDWA | Safe Drinking Water Act |
| SEA | Science and Engineering Associates |
| SIOP | Single Integrated Operational Plan |
| SIP | State Implementation Plan |
| SLBM | Submarine-launched Ballistic Missile |
| $SO_2$ | Sulfur Dioxide |
| SSBN | Nuclear-powered Ballistic Missile Submarine |
| SST | Safe Secure Transport |
| START | Strategic Arms Reduction Treaty |
| TDS | Total Dissolved Solids |
| TE | Transporter-erector |
| TLV | Threshold Limit Value |
| TSP | Total Suspended Particulates |
| US | United States |
| USAF | United States Air Force |
| USC | United States Codes |
| USFWS | United States Fish and Wildlife Service |
| USSR | Union of Soviet Socialist Republics |
| UST | Underground Storage Tanks |
| VOC | Volatile Organic Compounds |

# 1.0 PURPOSE OF AND NEED FOR THE PROPOSED ACTION

## 1.1 OVERVIEW

The Strategic Arms Reduction Treaty (START) is an agreement between the United States (US) and the Union of Soviet Socialist Republics (USSR) to reduce and limit the number of deployed Intercontinental Ballistic Missiles (ICBMs) and their launchers, Submarine Launched Ballistic Missiles (SLBMs) and their launchers, heavy bombers, and the total number of deployed warheads of ICBMs, SLBMs, and heavy bomber armaments. The proposed action evaluated in this Legislative Environmental Impact Statement (LEIS) is the US Senate's consent to ratify START. The purpose of the proposed action is to enable the US and the USSR to begin a mutually verifiable program to reduce and limit the number of deployed, strategic offensive arms.

## 1.2 FUNCTION AND SCOPE OF THIS DOCUMENT

This document has been prepared in accordance with the National Environmental Policy Act (NEPA) [42 United States Code (USC) 4321 et. seq.], the President's Council on Environmental Quality (CEQ) Regulations [40 Code of Federal Regulations (CFR) 1500-1508], the Department of Defense Directive 6050.1 [32 CFR 14], and, to the extent practicable, each service's regulation implementing NEPA. This includes Air Force Regulation 19-2 [32 CFR 989], Army Regulation 200-2 [32 CFR 651], and OPNAVINST 5090.1 [32 CFR 775] for the Navy. The CEQ regulations [40 CFR 1506.8] establish special procedures to be used for legislative actions.

This document provides input to government planning and decision-making. This document is also a "programmatic" EIS because it provides input to planning and decision-making regarding a range of program actions. In this case, the decision to be made — a legislative (US Senate) decision — is the consent to ratify START, and the program of actions for implementation of the Treaty.

This document describes the environmental impacts that could occur as a result of the Treaty. To the extent that the specific plans of the Department of Defense (DOD) for Treaty implementation are currently under development, this LEIS is intended to provide input to those plans so that the the Senate can be fully informed of the potential significance of environmental issues in the potential activities resulting from the Treaty. This document is not intended to serve as a substitute for later documents.

The LEIS focuses on the environmental issues affected by the decision at hand and is intended to be used to support subsequent tiers of environmental documents, in accordance with 40 CFR 1502.20. Tiering, which involves moving from general to specific analyses, eliminates repetitive discussions of the same issues. Therefore, future decisions associated with Treaty implementation will be analyzed in more specific, detailed NEPA documents that are prepared and presented as input to those future

decisions. These tiers of NEPA documents will build upon the foundation presented in this LEIS.

As stated in the CEQ regulations (40 CFR 1506.8), the LEIS has been submitted within 30 days of the date the legislative proposal (the Treaty) was submitted. Upon ratification of the Treaty, the US would finalize methods for carrying out the program of actions stemming from the Treaty.

## 2.0 PROPOSED ACTION AND ALTERNATIVES

The proposed action is the Senate's consent to ratify the Strategic Arms Reduction Treaty (START). The Senate has two other alternatives: to give consent conditional upon modifications of the Treaty or to refuse consent altogether. The US Senate could withhold its consent until and unless some modification is made to the Treaty. It is not possible to know what any such modification might be; therefore, no description of this alternative can be given. Section 2.1 describes the Proposed Action and Section 2.2 describes the "refusal to consent" option. Since "refusal to consent" would result in non-ratification of the Treaty by the US, this would constitute the "No Action" alternative. Section 2.3 provides an environmental comparison of the alternatives.

### 2.1 PROPOSED ACTION: CONSENT TO RATIFY START

The proposed action would limit the number of deployed US strategic offensive arms. The Treaty imposes an overall deployment limit of 1,600 to the number of heavy bombers, SLBMs and their launchers, and ICBMs and their launchers - sometimes referred to as silo launchers - and a limit of 6,000 for warheads attributed to deployed ICBMs, deployed SLBMs and deployed heavy bombers. The Treaty requires elimination of US launchers only if necessary in order to keep the total number of ICBM launchers, SLBM launchers, and heavy bombers below the Treaty limit. Additionally, the Treaty allows the US to make its own specific decisions as to the combination of deployed warheads, missiles, launchers, heavy bombers, and armaments that it will convert or eliminate to reach the overall deployment limits set by the Treaty. However, the US has not yet determined what combination it will select, although planning is currently being conducted in anticipation of Treaty ratification. Unlike the Intermediate-Range Nuclear Forces (INF) Treaty, the Treaty does not require the physical elimination of entire classes of strategic offensive arms. The treaty does not limit non-deployed, non-mobile missiles or non-deployed warheads, does not require elimination of non-mobile missiles or warheads, and does not restrict the methods now used or contemplated for non-mobile missile elimination.

The treaty limits the aggregate number of non-deployed ICBMs for mobile launchers of ICBMs to no more than 250. Currently, the US has 11 non-deployed ICBMs, Peacekeepers, for rail-mobile launchers of ICBMs. An additional 50 Peacekeepers are deployed in silo-launchers of ICBMs. These 50 missiles are also considered potential mobile missiles and subject to different treaty limitations than other ICBMs for silo launchers. The elimination process for ICBMs for mobile launchers of ICBMs specifically requires explosive demolition or burning if the propellant has not been removed and destruction of rocket nozzles, motor cases, as well as interstage skirts if the propellant has been removed.

According to the Treaty each heavy bomber equipped for long-range nuclear armaments, up to a total of 150 such heavy bombers, should be attributed with ten warheads. Above

150, these bombers would be attributed a number of warheads equal to the number of long-range nuclear armaments for which it is actually equipped. Each heavy bomber equipped for nuclear armaments other than long-range nuclear armaments should be attributed with one warhead.

This LEIS provides only a generic description and evaluation of the proposed action because the specifics of Treaty implementation are not fully defined in the Treaty. The Treaty contains extensive provisions related to counting weapons and makes provisions for a variety of inspections and for a Perimeter Portal Continuous Monitoring (PPCM) system at a missile or stage final assembly facility. The following sections briefly describe the strategic offensive arms which would be reasonably reduced or limited, potential locations in the US which would and could be affected by reducing, storing, and eliminating strategic offensive arms, and potential activities involved in the verification and validation of the Treaty.

### 2.1.1 DESCRIPTION OF STRATEGIC OFFENSIVE ARMS

The US strategic nuclear position provides flexibility through a mix of weapons systems. This mix includes a combination of SLBMs, ICBMs, and heavy bombers. The Air Force Strategic Air Command (SAC) operates and maintains the bombers and the ICBM force, while the US Navy operates and maintains the SLBM force.

#### 2.1.1.1 Heavy Bombers

The SAC bombers, capable of striking multiple targets with a variety of weapons, are the most flexible element of the US strategic nuclear force. Launched under positive control, they have the option to strike or be recalled as the situation dictates. The strategic bomber force currently consists of the B-52 and the B-1B. The B-2, an advanced-technology bomber, is currently being designed and developed for deployment at Whiteman AFB, Missouri.

#### 2.1.1.2 Intercontinental Ballistic Missiles and Launch Components

The second element of the US strategic nuclear force is the land-based missiles, of which there are 1,000 deployed. The primary components of the ground system for the ICBM force are the Launch Facility (LF) and Launch Control Facility (LCF).

##### 2.1.1.2.1 Launch Facilities and Launch Control Facilities

The LF, more commonly referred to as a silo, is a cylindrical, steel-lined concrete tube which houses the missile. It is twelve feet in diameter and extends approximately ninety feet underground. Next to the silo is an underground support building containing environmental control equipment and a standby power source. An underground diesel-fuel tank is adjacent to the support building. Throughout the ICBM force, the tanks vary

in size from 2,500 to 15,000 gallons and are buried four to forty feet underground. The electrical filters in the support equipment may contain polychlorinated biphenyls (PCBs). Additionally, some diesel generators in the support buildings have an exhaust system and radiator plenum that contain asbestos. Sodium chromate solution is another hazardous material used in the LFs. At some LFs, there are two 150-gallon obsolete tanks that formerly contained sodium chromate.

Organizationally, LFs are grouped into "flights" and "squadrons," with ten missiles per flight and five flights per squadron. Normally covering approximately two acres, each unmanned LF is a minimum of three miles from another LF in the flight. Each flight of ten missiles is interconnected by a buried cable network to a Launch Control Center (LCC) at the LCF. The LCC is buried 40-100 feet underground and is continuously manned by two crew members who control and monitor the LFs. An aboveground support building and living quarters for topside personnel are also part of the LCF. The LCFs have underground diesel fuel tanks equivalent to the ranges in size and depth of the LF tanks. Asbestos and PCBs may be used at the LCF for purposes similar to their use at the LF. An LCF is at least fourteen miles from the other four LCFs in a squadron.

### 2.1.1.2.2 Intercontinental Ballistic Missiles

The current operational ICBM force includes a mix of Minuteman II, Minuteman III, and Peacekeeper missiles. The Minuteman (MM) Force Modernization Program initiated replacement of all MM I missiles with MM IIs or IIIs from 1966 through 1974. Minuteman I missiles are currently in storage at Hill AFB and Tooele Army Depot.

The Minuteman II, the oldest design in use, has three stages of solid-fuel rocket motors. The MM III is similar to the MM II in solid fuel composition and size, but employs a liquid-based fuel in a Propulsion System Rocket Engine (PSRE). Peacekeeper has three stages and a self contained dispensing mechanism (SCDM). The three stages are all solid-fuel rocket motors while the SCDM contains some liquid-fuel. The liquid fuel sections of the MM III and the Peacekeeper consist of a monomethyl hydrazine ($N_2H_3CH_3$) fuel tank and an oxidizer tank (nitrogen tetroxide [$N_2O_4$]). Both Peacekeeper and Minuteman have an inertial guidance system with a nuclear payload. Table 2-1 indicates the class of the propellants and their primary components. Class 1.3 propellant is composed primarily of ammonium perchlorate (AP), aluminum, and epoxy resin, and Class 1.1 propellant contains the aforementioned constituents, in addition to nitroglycerin, cyclo-tetramethylene tetranitramine (HMX), and nitrocellulose. The class of propellant will determine both rocket motor storage maintenance requirements, such as quantity-distance zones, and the feasibility of propellant removal or elimination techniques. For example, as mentioned in a subsection of Section 2.3.3.3, "Water Jet Washout" is a method of removing propellant from motor casings that is only applicable to class 1.3 propellants.

| Table 2-1<br>Ballistic Missile Characteristics | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Partial List of Fuel Constituents | | | | | | |
| Type | Class | Ammonium Perchlorate | Aluminum | Epoxy Resin | Nitro-glycerin | HMX[2] | Nitro-cellulose | Monomethythydrazine and Nitrogen Tetroxide |
| Minuteman II | | | | | | | | |
| Stage 1 | 1.3 | • | • | • | | | | |
| Stage 2 | 1.3 | • | • | • | | | | |
| Stage 3 | 1.1 | • | • | • | • | • | • | |
| Minuteman III | | | | | | | | |
| Stage 1 | 1.3 | • | • | | | | | |
| Stage 2 | 1.3 | • | • | | | | | |
| Stage 3[1] | | | | | | | | |
| PBCS[3] | | | | | | | | • |
| Peacekeeper | | Composition not available | | | | | | |
| Stage 1 | | | | | | | | |
| Stage 2 | | | | | | | | |
| Stage 3 | | | | | | | | |
| SCDM[4] | | | | | | | | • |
| Poseidon (C-3) | | | | | | | | |
| Stage 1 | 1.3 | • | • | | | | | |
| Stage 2 | 1.1 | • | • | | • | • | • | |
| Trident I (C-4) | | | | | | | | |
| Stage 1 | 1.1 | • | • | | • | • | • | |
| Stage 2 | 1.1 | • | • | | • | • | • | |
| Stage 3 | 1.1 | • | • | | • | • | • | |
| Trident II (D-5) | | | | | | | | |
| Stage 1 | 1.1 | • | • | | • | • | • | |
| Stage 2 | 1.1 | • | • | | • | • | • | |
| Stage 3 | 1.1 | • | • | | • | • | • | |

Minuteman II data (HQ-AFLC, 1990)
Minuteman III data (USAF, undated)
Peacekeeper data (Janes, undated)
[1] Composition not available.
[2] cyclotetramethylenetetranitramine
[3] Post Boost Control System includes the Propulsion System Rocket Engine
[4] Self-Contained Dispensing Mechanism

Both solid and liquid fuels are characterized as ignitable compounds. Other hazardous compounds in some of the missiles include asbestos, which lines the casing, nozzles, and other heat-deflecting portions of the missiles (17), and Kevlar™, a casing material for the Peacekeeper missiles that produces hydrogen cyanide when burned.

#### 2.1.1.3 Strategic Missile Submarines and Submarine-Launched Ballistic Missiles

The third and final element of the US strategic nuclear force is the ballistic missile submarine. The Strategic Missile Submarine (SSBN) program was initiated in 1960 and functions as the most survivable and enduring leg of the US strategic nuclear position.

#### 2.1.1.3.1 Strategic Missile Submarines

As of 1 December 1991, the US has 23 strategic submarines in the force that supports the US Single Integrated Operational Plan (SIOP), including 11 submarines of the James Madison and Benjamin Franklin classes, four Trident II (D5) configured, and eight Trident I (C4) configured, Ohio class submarines. Twelve vessels of the earlier classes were converted to carry the Trident I missile with one subsequently offloaded for retirement. These vessels of the earlier class are based at the Polaris Missile Facility Atlantic at Charleston, South Carolina. The Trident II configured submarines are based at the Strategic Weapons Facility Atlantic at Kings Bay, Georgia.

The Ohio Class Trident SSBN is a state-of-the-art replacement for aging fleet ballistic missile submarines built during a short period in the 1960s. Each Ohio Class Trident submarine is far more capable than the Poseidon submarine it replaces, in both numbers of missiles carried and destructive capability. Poseidon submarines will reach obsolescence and will be retired and replaced by the Ohio Class Trident submarines during the 1990s.

The first eight Ohio class ships (Trident I), based at the Strategic Weapons Facility Pacific at Bangor, Washington, are configured to carry 24 Trident I (C4) SLBMs. Beginning with the ninth Trident submarine, the USS Tennessee (SSBN-734), all newly constructed SSBNs will be equipped with the Trident II missiles. Possible U.S. plans call for reconfiguration of the first Ohio class submarines to carry the Trident II missile. Eventually, all Trident submarines may be configured to carry Trident II missiles.

Ohio class submarines have a length of 560 feet and a beam of 42 feet, and displace 18,700 tons when submerged. They are built with 24 launch tubes for Trident I and II missiles and four torpedo tubes. Ohio class submarines are manned by two alternating crews of 156 each.

The Poseidon SSBNs (Benjamin Franklin and James Madison classes) measure 425 feet in length and 33 feet in beam. These ships are built with sixteen launch tubes for Poseidon or Trident I missiles and four torpedo tubes. Poseidon class submarines are manned by two alternating crews of 137 each.

#### 2.1.1.3.2 Submarine Launched Ballistic Missiles

Currently, there are three types of Submarine Launched Ballistic Missiles (SLBMs) deployable in the Naval inventory: the Poseidon, or C3; the Trident I, or C4; and the Trident II, or D5. All three SLBMs use solid fuel. The propellant ingredients for these SLBMs are shown in Table 2-1.

The C3 is a two-staged missile with stage one containing class 1.3 solid propellant and stage 2 containing class 1.1 solid propellant. The solid rocket motor cases for both

stages are made of Spearalloy, a combination of fiberglass and epoxy resin. The Poseidon first entered the US inventory in March 1971.

To increase the full payload range of the SLBMs, and consequently eliminate the need for overseas basing of SSBNs carrying the Poseidon and the earlier Polaris missile, the US developed the C4, or Trident I, missile. The C4 is a three-staged missile with all three stages containing class 1.1 solid propellant. Kevlar™ fiber materials comprise the cases of the rocket motors. The first Trident I became operational in October 1979.

An improved range and accuracy program for SLBMs was initiated in 1975 resulting in the development of the Trident II missile. All three stages contain class 1.1 solid rocket propellant and have epoxied graphite casings.

### 2.1.2 POTENTIALLY AFFECTED LOCATIONS

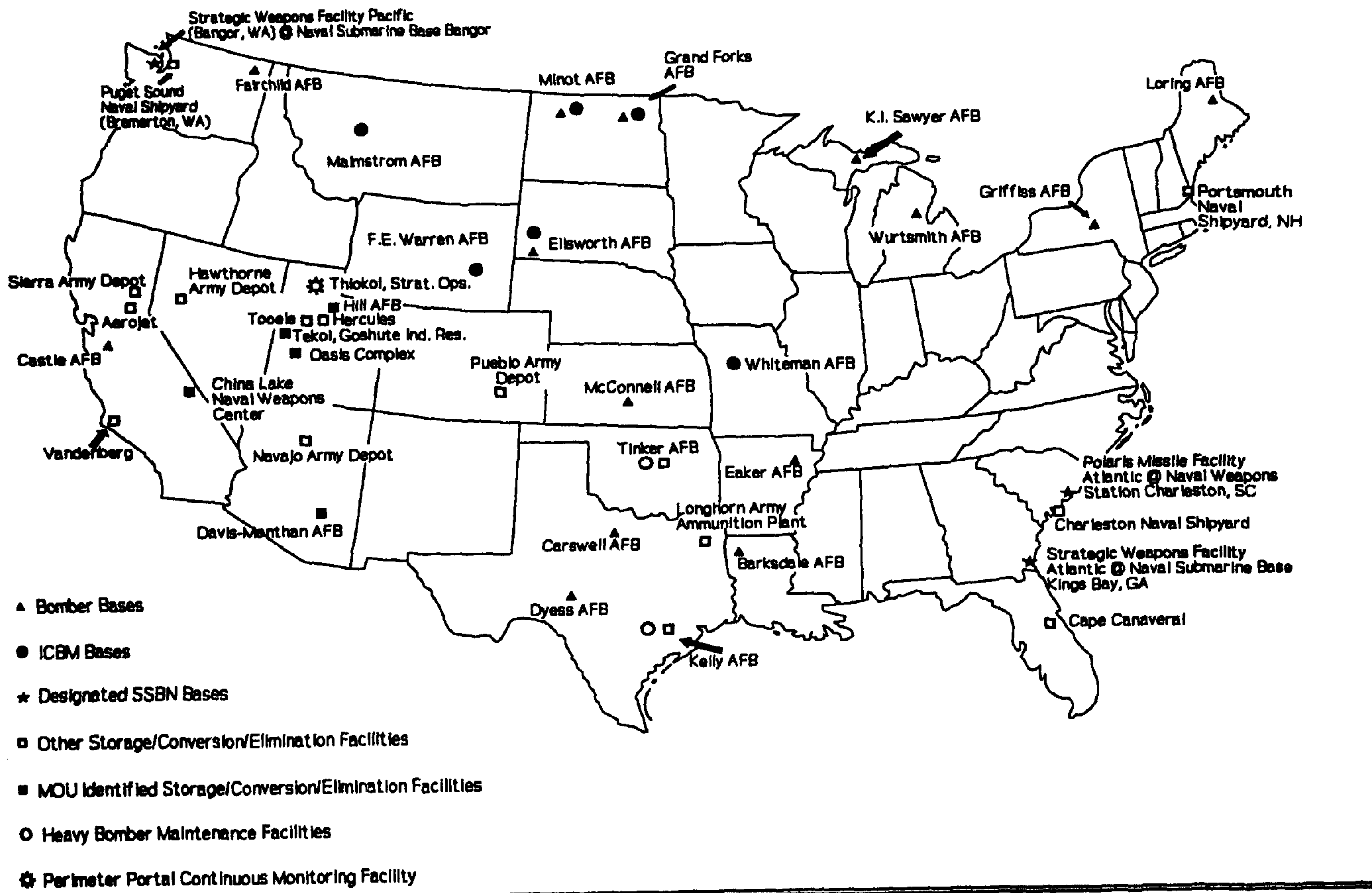
Treaty implementation would involve various types of installations: Air Force and Navy operational bases, logistics bases, test ranges, and facilities where components of ballistic missiles are produced. Specific bases and facilities that would be involved have been identified in the Treaty Memorandum of Understanding (MOU). The MOU establishes the data base relating to the Treaty. This data base contains technical and locational information on ICBMs and ICBM launchers, SLBMs and SLBM launchers, heavy bombers, long-range nuclear air-launched cruise missiles, fixed structures for mobile launchers of ICBMs, support equipment, and related facilities. The installations where the weapon delivery systems are presently deployed represent a broad range of locations which would be affected by the Treaty. A map of the facilities that would be affected by Treaty implementation and other facilities that could be affected is shown in Figure 2-1, and Table 2-2 lists these locations.

Table 2-3 lists the locations of facilities where storage of boosters and conversion or elimination of bombers would take place as identified in the Treaty MOU (asterisked items) as well as other sites for the storage, conversion, or elimination of the various strategic offensive arms. Future tiers of analysis and decision-making could determine that one or more sites not on this list could be involved in Treaty implementation.

#### 2.1.2.1 Heavy Bomber Bases

The two types of heavy bombers currently in the AF inventory include the B-52 and the B-1B. The current inventory of 172 B-52s equipped for long-range nuclear armaments is distributed geographically at eight separate Air Force Bases located in seven states. Another 51 B-52s equipped for nuclear armaments other than long-range nuclear armaments are based at Loring AFB, Maine and Castle AFB, California. The inventory of 97 B-1Bs is located in four states: South Dakota, North Dakota, Kansas, and Texas.

## Figure 2-1
## Potential Implementation Locations



| Table 2-2<br>Locations of MOU Identified Deployed Weapon Delivery Systems | | |
|---|---|---|
| **Heavy Bomber Bases** | | **Designated SSBN Bases** |
| **B-52** | **B-1B** | |
| ▲ Barksdale, LA<br>▲ Carswell, TX*<br>▲ Castle, CA<br>▲ Eaker, AR<br>▲ Fairchild, WA<br>▲ Griffiss, NY*<br>▲ Loring, ME<br>▲ Minot, ND<br>▲ KI Sawyer, MI<br>▲ Wurtsmith, MI | ▲ Ellsworth, SD*<br>▲ Dyess, TX*<br>▲ Grand Forks, ND*<br>▲ McConnell, KS* | ■ Charleston, SC<br>■ Bangor, WA<br>■ Kings Bay, GA |
| **Intercontinental Ballistic Missile Bases** | | |
| **MM II** | **MM III** | **Peacekeeper** |
| • Ellsworth, SD<br>• Malmstrom, MT<br>• Whiteman, MO | • Grand Forks, ND<br>• Malmstrom, MT<br>• Minot, ND<br>• FE Warren, WY | • FE Warren, WY |

* Bases with heavy bombers equipped for nuclear armaments other than long-range nuclear armaments.
Symbols correspond to legend in Figure 2-1.

| Table 2-3<br>Locations of Storage, Conversion or Elimination Facilities | | | | |
|---|---|---|---|---|
| **Aircraft** | **ICBMs** | | **Submarines** | **SLBMs** |
| ■ Davis-Monthan, AZ<br>□ Kelly, TX<br>□ Tinker, OK | □ Aerojet, CA<br>□ Cape Canaveral, FL<br>□ Hawthorne, NV<br>□ Hercules, UT<br>■ Hill, UT<br>□ Longhorn, TX<br>■ Oasis Complex, UT | □ Pueblo, CO<br>□ Sierra, CA<br>■ Tekoi, UT<br>✲ Thiokol, UT<br>□ Tooele, UT<br>□ Vandenberg, CA<br>■ China Lake, CA<br>□ Navajo, AZ | □ Charleston, SC<br>□ Portsmouth, NH<br>□ Puget Sound, WA | ★ Charleston, SC<br>★ Bangor, WA<br>★ Kings Bay, GA<br>■ China Lake, CA<br>■ Tekoi, UT<br>□ Sierra, CA** |

** Navy is requesting Sierra be added to MOU.
Symbols correspond to legend in Figure 2-1.

### 2.1.2.2 ICBM Bases

The MM II, MM III, and Peacekeeper missiles are located within 100 miles of six different Air Force bases. Each AFB has a deployment area of approximately 3,500 to 6,000 square miles adjacent to it. The LFs and LCFs are distributed throughout the deployment areas. The 1,000 ICBMs are deployed in five states as shown in Figure 2-1.

Two of the bases deploy more than one type of ICBM: Malmstrom AFB has both MM IIs and IIIs, and F.E. Warren AFB has both MM IIIs and Peacekeepers. Minot, Grand Forks, and Ellsworth AFBs support both bomber and ICBM missions. Malmstrom AFB also supports a tanker mission along with the MMs. Whiteman AFB currently has only the one ICBM mission, but will soon have a bomber mission with the deployment of the B-2.

### 2.1.2.3 Designated SSBN Bases

The US Navy has three designated locations with bases that will be affected by Treaty implementation as elements of the overall verification regime. These locations, as identified in the MOU and shown in Figure 2-1, include the Strategic Weapons Facility Pacific in Bangor, WA, the Polaris Missile Facility Atlantic in Charleston, SC; and the Strategic Weapons Facility Atlantic in Kings Bay, GA. The bases associated with these facilities are Naval Submarine Base Bangor, Naval Weapons Station Charleston, and Naval Submarine Base Kings Bay, respectively.

The Naval Weapons Station Charleston occupies land in two separate areas just north of Charleston, SC: Main Station and South Annex. The station's mission is to provide homeport and logistics support for two ammunition ships, a floating drydock, a submarine tender, and the assigned SSBNs of one submarine squadron. It also provides material support for assigned weapons and weapon systems and provides support for the Polaris Missile Facility Atlantic, which in turn provides Poseidon and Trident I missiles to the Atlantic Fleet.

Naval Submarine Base Kings Bay is located in southeastern Georgia, approximately eight miles north of the Florida state border. The base supports two squadrons of SSBNs. Naval Submarine Base Bangor is the support site for the SSBNs of the US Pacific Fleet. It is located on the eastern shore of the Hood Canal in Kitsap County, WA, approximately twelve miles from the Puget Sound Naval Shipyard in Bremerton, WA, and approximately thirty miles from Seattle, WA.

Both Kings Bay and Bangor have Trident refit facilities, which provide industrial support for incremental overhaul and intermediate-level maintenance; Trident training facilities, which provide team and individual training for SSBN crews; and strategic weapons facilities, which provide strategic missiles and strategic weapon system support. The strategic weapons facility at Kings Bay supports Trident II (D5) SLBMs, and the facility at Bangor supports Trident I (C4) SLBMs.

### 2.1.2.4 Storage, Conversion, or Elimination Facilities

Of the sites identified in Table 2-3, only one conversion or elimination facility (Davis-Monthan AFB) and three booster storage facilities (Oasis Complex, China Lake, and Tekoi) have been identified in the Treaty MOU. Other potential storage areas include Pueblo Army Depot, Colorado and Navajo Army Depot, Arizona. Davis Monthan AFB, Arizona has been identified as the location for the conversion and elimination of heavy bombers while Kelly AFB, Texas and Tinker AFB, Oklahoma, identified as heavy bomber repair facilities in the Treaty MOU, are potential locations for interim storage and conversion of heavy bombers. Hill AFB, located in northern Utah, also identified in the MOU, would serve as a preparation facility prior to placing boosters in storage. Hill AFB currently is the maintenance support facility for both MM and Peacekeeper solid rocket boosters. Vandenberg, California and Cape Canaveral, Florida are two potential locations for the use of converted missiles for research and development purposes. The facilities identified in the MOU would be utilized while eighteen other sites listed in Table 2-3 have the potential to be utilized. Locations in California and Utah account for a majority of these facilities.

There are three locations for currently scheduled SSBN conversion, elimination, and storage activities: Puget Sound Naval Shipyard, WA; Portsmouth Naval Shipyard, NH; and Charleston Naval Shipyard, SC. Implementation of the Treaty will not require additional eliminations and therefore will not require additional conversion and elimination sites.

China Lake Naval Weapons Center in California and Tekoi Test Facility at the Goshute Indian Reservation in Utah would be used for the storage of SLBMs, and three designated SSBN bases would provide interim SLBM storage. These SSBN bases are the same as the designated SSBN bases described in Section 2.1.2.3.

### 2.1.3 POTENTIAL TREATY VERIFICATION PROCEDURES

The Treaty requires several types of verification activities to allow representatives of the USSR to ensure that the US is complying with Treaty requirements. These activities consist of baseline inspections and information exchanges, elimination validations using a variety of national technical means (e.g., satellites) and sensors, PPCM, and short-notice inspections of weapons facilities.

Table 2-4 lists other elements of the START verification regime not previously identified in Table 2-2 and Table 2-3 but identified in the MOU. These facilities would not experience environmental effects as a result of the Treaty and are either locations of non-deployed or training models of treaty accountable weapons, production facilities, or designated points of entry for Soviets arriving in the US.

| Table 2-4<br>Other Elements of the START Verification Regime | | |
|---|---|---|
| **Facility** | **Location** | **Activity** |
| General Dynamics Corporation | Groton, Connecticut | SSBN Production Facility |
| Trident Training Facility Bangor | Silverdale, Washington | SLBM Training (Models Present) |
| Submarine Training Facility | Charleston, South Carolina | SLBM Training (Models Present) |
| Naval Guided Missile School Dam Neck | Virginia Beach, Virginia | SLBM Training (Models Present) |
| Trident Training Facility, Kings Bay | Kings Bay, Georgia | SLBM Training (Model Present) |
| Northrop Plant | Palmdale, California | Production Facility for Heavy Bombers (HBs) and Former HBs |
| Rockwell Plant | Palmdale, California | B-1 Repair Facility |
| Edwards Air Force Base | California | HB Flight Test Center |
| San Francisco | California | Western Designated Point of Entry |
| Washington | District of Columbia | Eastern Designated Point of Entry |

The locations and numbers of non-deployed weapons currently on static display which are not subject to static display limitations specified in the Treaty are also provided in the MOU. This information serves as a baseline to which future static display items can be added. No significant adverse environmental impacts would be expected to occur at these locations.

Baseline inspections at missile operating bases and support facilities could begin soon after the Senate's consent to ratify the Treaty. Although the number of inspectors varies with the type of inspection, a team of approximately fifteen Soviet inspectors may visit a US facility accompanied by US escorts from the On-Site Inspection Agency.

In contrast to the transient nature of the inspection parties mentioned above, the PPCM may involve essentially permanent presence by Soviet inspectors. This form of monitoring enables the Soviets (and, in the USSR, the US) to verify that the limits on production of specified weapons systems are being met.

A perimeter Portal Continuous Monitoring system would be constructed at the portal of one identified missile or stage final assembly facility, Thiokol Strategic Operations, Promontory, Utah, to verify the provisions of the Treaty. The PPCM is an operations center that is fenced in, with an entrance and an exit. The PPCM is constructed on government or government contractor's property and, generally, will need a roadway, high fence, and firebreak. Inside the portal will be a special rail and roadway with a built-in scale to weigh trucks exiting the facility, and infrared scanners mounted on the portal's posts and guard rails to measure the size of trucks exiting the production facility. Further verification may be made from the operations center inside the PPCM, where technicians could utilize a wide variety of photographic and sensing technology to insure compliance with the provisions of the Treaty.

## 2.2 NO ACTION ALTERNATIVE: NON-RATIFICATION OF START

If the Senate decides not to consent to ratify the Treaty, then strategic weapons deployments and activities would continue in accordance with the current Defense plan, and in response to continuing assessment of mission needs.

### 2.2.1 NO ACTION ALTERNATIVE OVERVIEW

Routine operations, flights, sea patrols, and training would continue, as would maintenance and refits. In addition, the strategic modernization programs already underway under the Defense Plan would likely continue. In fact, even under a Treaty, at least some aspects of modernization would continue. Currently, the U.S. has 2,246 deployed ICBMs and their associated launchers, deployed SLBMs and their associated launchers, and deployed heavy bombers and 10,563 warheads attributed to these deployed strategic offensive arms. Of the 10,563 warheads, 8,210 are attributed to deployed ICBMs and deployed SLBMs.

The bomber element of the US strategic nuclear force is presently being modernized with the addition of the B-2, known as the Stealth bomber. Deployed B-1Bs will continue to operate from bases identified in Table 2-2. As part of the modernization process, B-52s are being retired. The plan to develop and deploy additional Peacekeeper missiles in a rail-mobile mode will not likely occur because no funds have been appropriated by Congress and the President has proposed canceling the plan. The Air Force is retiring the MM IIs, which are nearing the end of their planned service life. The SSBN/SLBM element is undergoing modernization with continuing production and deployment of Ohio-class submarines and Trident II (D5) missiles. Ohio class submarines initially configured with Trident I (C4) missiles may be converted to Trident II (D5) missiles in the future. The SSBNs with C3 missiles and non-Ohio class submarines with C4 missiles are being retired.

Because the program of actions that will result from the Treaty is not prescribed by the Treaty, the degree to which START will affect these modernization programs is not known. The baseline against which environmental impacts are to be assessed is, therefore, an unusually complex and dynamic concept. In the absence of the Treaty (the "no action" alternative), many strategic weapons-related actions, primarily including retirement and modernization, will commence or continue to occur. These current and planned actions have, or will have, various environmental impacts. The environmental impacts that occur in the absence of the Treaty will form the baseline against which to discern the differences in the impacts under the Treaty. The cumulative or combined impacts of Treaty-caused actions that could occur can also be discerned from this baseline.

### 2.2.2 NO ACTION ALTERNATIVE SPECIFIC TO SLBM SYSTEMS

Certain actions related to strategic weapon systems are expected to be undertaken regardless of whether the Treaty is ratified or not. These actions are expected to result in a reduction in the total number of deployed SLBM launchers from 584 as of 30 September 1990 to 432 in 1998. Currently approved plans with respect to SLBM systems are described in the SSP document SPOSE 2-92, which reflects the baseline program.

Current plans call for continuing to construct Ohio-class SSBNs until at least the eighteenth authorized unit is deployed in FY 98. The number of SLBM launchers deployed in Ohio-class SSBNs is expected to increase from 216 as of 30 September 1990 to 432 in 1998. Additionally, all pre-Ohio class SSBNs, except for two which will be converted to non-SLBM uses, will be retired. Retirement of these SSBNs began in FY 80, and the last one is expected to be retired in FY 98. The number of SLBM launchers in pre-Ohio class SSBNs is expected to decrease from 368 as of 30 September 1990 to zero in 1998.

As the older SLBM systems are withdrawn from service, it becomes necessary either to store the retired missiles or to eliminate them. These SLBMs are now stored at SSBN bases and are expected to continue to be stored there. The Navy is currently disposing of some SLBM solid rocket motors by open burning/open detonation under contract at Sierra Army Depot, and expects to continue to do so. The Navy is currently conducting research and development in preparation for the construction of a facility in which SLBM solid rocket motors would be burned under conditions which would reduce emissions of pollutants. The determination of whether and where to construct this facility will not be made until the completion of the research and development effort. The construction of this new facility would represent an action that is independent of the Treaty.

Under the present program, SSBNs being removed from service are brought to one of several qualified shipyards for inactivation and dismantling of the missile sections. Under the terms of the Treaty, an SSBN will be considered to be no longer accountable when the SLBM launch tubes have been cut from the vessel. This removal process is required to be completed within the Treaty-specified time frame. There will be no on-site inspection of the removal activity; instead, verification that elimination has been accomplished in accordance with protocol would be accomplished by the Soviet Union's national technical means (e.g., satellites). Section 2.1.3 discusses the verification aspect of the Treaty.

As part of inactivation, surplus and salvageable equipment is removed from the vessel and returned to the Navy's logistics channels. Removal of SLBMs requires special handling equipment that is available only at selected ports. All other ordnance (e.g., torpedoes, launch tube closure detonators and gas generators, emergency beacons, and small arms munitions) is removed from the submarine.

At the shipyard, the nuclear fuel in the submarine's reactor is removed from the reactor section and returned to DOE for transportation to the Idaho National Engineering Laboratory.

The SSBN is brought into drydock and placed on wooden and concrete blocks. Some of these blocks are placed on tracks to facilitate separation and rejoining of the vessel. The missile tube launch hatches are removed first. Shipyard workers use cutting torches or comparable technology and remove the missile compartment by cutting it into several sections. Tracked cutting torches may be used on the hull surface.

The SSBN is then welded back together, minus the missile compartment, and placed in waterborne storage. Where required, the defueled reactor compartment of an SSBN is removed and disposed of as described in the 1984 Final Environmental Impact Statement on the Disposal of Decommissioned, Defueled Naval Submarine Reactor Plants.

Hazardous substances within the submarine that may be encountered in missile compartment removal include lead, chromium, cadmium, asbestos, and, for some submarines, PCBs. Hazardous substances are handled and disposed of in accordance with the requirements of 40 CFR 262 through 270, 40 CFR 61, and 40 CFR 761. Asbestos and PCBs are regulated under the Toxic Substance Control Act (TSCA) at the Federal level. Some states regulate PCBs and/or asbestos as hazardous waste.

Removal of PCB felt used for sound isolation will be detailed here as an example of how these materials are handled in accordance with the applicable regulations. Removal of PCBs is accomplished by pulling the felt from structural steel surfaces and using mechanical means, such as scrapers and wire brushes, to remove loosely adherent wool felt and paint. Final cleaning of the steel is accomplished using a series of solvent washes and rinses. A final degreasing wash and rinse step is performed using an aqueous-based solvent prior to sampling the surface to ensure it has been adequately cleaned. Workers are required to wear proper personal protective equipment while performing this work.

Solid waste which contains PCBs is initially placed in polyethylene bags, labeled with required PCB labels, and marked to identify contents. Bags of solid waste which contain PCBs are packaged into 55 gallon, Department of Transportation (DOT) Specification 17C drums. Liquid wastes containing regulated levels of PCBs are placed in 55 gallon, DOT Specification 17E drums. Applicable labels are placed on all drums. The drums are transported from the shipyard by a permitted treatment, storage, and disposal transporter to a chemical waste landfill or a PCB incinerator meeting the requirements of 40 CFR 761.

Even without ratification of the Treaty, elimination of SSBNs will continue as scheduled. That is, START limits for SLBM launchers do not impact current plans for the retirement of SSBNs. Also, normal retirement/deactivation activities for SSBNs meet the

conversion/elimination requirements of SLBM launchers under the Treaty. Therefore, the normal activities that will continue under the No Action Alternative are identical to those that would occur if the Treaty is ratified.

## 2.3 COMPARISON OF ALTERNATIVES

### 2.3.1 COMPARISON OF ALTERNATIVES OVERVIEW

There are many combinations of methods of elimination and potential locations available to reduce strategic offensive arms within the proposed action alternative. Table 2-5 compares the proposed action with the no action alternative for all potentially-affected US strategic offensive arms and nuclear components. The table summarizes current and no action activities involving heavy bombers, ICBMs and associated launchers, SLBMs and associated launchers, and nuclear warhead components, with potential changes in operations anticipated with the proposed Treaty ratification action. A key factor derived from this comparison analysis is that for many strategic offensive weapon systems, operations and activities under the proposed action and no action alternatives may remain essentially unchanged. In several instances, the only change resulting from the proposed action may result in the level of weapon system activities; e.g., increased missile/aircraft removal from deployed status, and other processes.

Although no formal allocation of START-limited launcher numbers has been made between SLBM and ICBM systems, it is not expected that SLBM launcher reductions beyond those described under the no action alternative (Section 2.2) will be required to keep the total number of launchers below the treaty limit. For that reason the proposed action is not expected to have any effect on the deployment of SLBM systems, other than to preclude the US from undertaking any significant increases beyond those already planned and to commit the US to a level of net reduction similar to that already planned.

The ratification of the Treaty will not have any effect on the United States' options to store or eliminate SLBMs.

The verification activities required by the Treaty will require modest physical accommodations at some SLBM-related sites, including the construction of a PPCM system at one solid rocket motor production facility, Thiokol Strategic Operations, Promontory, UT, which would not be required otherwise.

### 2.3.2 COMPARISON OF THE ENVIRONMENTAL EFFECTS OF THE ALTERNATIVES

Table 2-6 compares the environmental effects associated with the changes in strategic offensive arms programs, presented in Table 2-5, under the proposed action (Treaty ratification) versus the no action alternative. The no action alternative serves as the baseline for the environmental impact analysis.

## Table 2-5
## Summary Comparison of the Proposed Action with the No Action Alternative

| No Action Alternative: Non-Ratification of START | | | | |
|---|---|---|---|---|
| Heavy Bombers | ICBMs and Associated Launchers | | SLBMs and Associated Launchers | |
| | ICBM Launchers (Silos) | ICBMs | SLBM Launchers (SSBNs) | SLBMs |
| • Routine bomber operations, training, and maintenance<br>• Continue proposed force modernization<br>• Deactivation, storage, and retirement of obsolete bombers | • Continued operation and maintenance<br>• Possible upgrading and modernization of facilities<br>• Deactivation of obsolete launchers | • Continued modernization & replacement with new missile systems<br>• Possible deactivation, storage, & elimination of obsolete missile systems<br>• Continued ICBM removal & transport to maintenance facilities<br>• Warheads - Continued transportation, dismantlement, & fissionable material recycling from warheads | • On-going maintenance<br>• Elimination or conversion of submarines with C3 missiles and non-Ohio class submarines with C4 missiles<br>• Deployment of Ohio Class submarines with D5 missiles, including those initially configured with C4 missiles | • Cease deployment of C3 and C4 missiles<br>• Continued deployment of D5 missiles<br>• Warheads - Continued transportation, dismantlement, & fissionable material recycling from warheads |
| **Proposed Action: Ratification of START** | | | | |
| Heavy Bombers | ICBMs and Associated Launchers | | SLBMs and Associated Launchers | |
| | ICBM Launchers (Silos) | ICBMs | SLBM Launchers (SSBNs) | SLBMs |
| Increased:<br>• Storage, conversion, & elimination of heavy bombers<br>• Possible construction of additional facilities to support proposed action | • Elimination of some launchers<br>• Modification of launch control facility to negate launch capability | Increased:<br>• Storage, conversion, & elimination<br>• Possible construction of additional missile storage buildings<br>• Potential construction of additional facilities to support proposed action<br>• Warheads - Plan & implement larger scale program of warhead transportation, dismantlement, and recycling | • Same as No Action Alternative<br>• US can meet Treaty reduction requirements under current conversion, retirement, & elimination plans | • Same as No Action Alternative<br>• Navy can meet Treaty reduction requirements under current conversion, retirement, and elimination plans<br>• Warheads - Continued transportation, dismantlement, & fissionable material recycling from warheads |

## Table 2-6
## Summary Comparison of the Environmental Effects of the No Action (NA) Alternative and the Proposed Action (PA)

| Heavy Bombers | | ICBMs and Associated Launchers | | | | SLBMs and Associated Launchers | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | ICBM Launchers (Silos) | | ICBMs | | SLBM Launchers (SSBNs) | | SLBMs | |
| NA | PA | NA | PA | NA | PA | NA | PA | NA | PA |
| **DEPLOYMENT BASES** | | | | | | | | | |
| Continuing:<br>• Air & noise emissions<br>• Hazardous waste generation & disposal<br>• Potential fuel spill contamination of soil & ground water<br>• Potential risk to human health & safety<br>• Potential force structure change, realignment, & base closures with associated employment fluctuations | Long-term:<br>• Reduction of noise & air emissions<br>• Reduction in hazardous waste generation & disposal from maintenance of reduced number of aircraft<br>• Potential decreased employment<br>• Reduction in risks to human health & safety from reduced air traffic & handling of hazardous wastes | Continuing:<br>• Potential soil contamination from herbicide use<br>• Employment from operation & maintenance | Long-term:<br>• Reduction in soil contamination from herbicide use<br>• Reduction in operational & maintenance employment<br>• Potential impacts from silo elimination including disruption to geology, soils & aquifers | Continuing:<br>• Potential risk to human health & safety from removal & transport to maintenance facility<br>• Potential force structure change, realignment & base closures with associated employment fluctuations<br>• Warheads - Potential risk to human health & safety from removal, transport & maintenance | Long-term:<br>• Reduction in potential transportation/ handling risks to human health & safety<br>• Reduction in potential risk to human health & safety from operations & maintenance activities<br>• Warheads - Reduced potential risk to human health & safety resulting from reduced transportation & maintenance activities | Continuing:<br>• Impacts on air quality, noise, & transportation<br>• Employment from operation & maintenance | Same as No Action | Continuing:<br>• Potential risk to human health & safety from removal & transport to maintenance facility<br>• Warheads - Potential risk to human health & safety from removal, transport & maintenance | Same as No Action |
| **STORAGE, CONVERSION, AND ELIMINATION FACILITIES** | | | | | | | | | |
| Continuing:<br>• Employment from operational support<br>• Hazardous waste generation & disposal<br>• Air & noise emissions | Short-term:<br>• Increase in operational employment<br>• Increase in hazardous waste generation & disposal<br>• Increase in air & noise emissions | See Deployment Bases | See Deployment Bases | Continuing:<br>• Potential elimination of obsolete ICBMs by static fire, open burn & launch R&D resulting in air & noise emissions<br>• Employment from operational support<br>• Storage & maintenance of back-up ICBM inventory<br>• Warheads - Potential risk to human health & safety from removal, transport, handling & recycling warheads | Short-term:<br>• Potential increase in elimination rate of ICBM boosters by static fire, open burn & launch R&D resulting in air & noise emissions<br>• Potential increase in employment for operations, maintenance & construction activities<br>• Long-term increase in storage & maintenance of ICBM boosters & components<br>• Warheads - Increase risk from dismantling & recycling increased number of warheads & potential capacity problem from handling & transporting additional warheads | Continuing:<br>• Potential human health & safety risk to hazardous materials exposure from elimination activities<br>• Industrial safety risks | Same as No Action | Continuing:<br>• Potential elimination of obsolete SLBM boosters by static fire, open burn & launch R&D resulting in air & noise emissions<br>• Employment from operational support<br>• Storage & maintenance of back-up SLBM inventory<br>• Warheads - Potential risk to human health & safety from removal, transport & maintenance | Same as No Action |

The environmental impacts under the proposed action will vary depending on the method used for managing strategic offensive arms once they are removed from deployed status. The analysis considers environmental effects to both the deployment bases and the facilities for storage, conversion, or elimination of strategic offensive arms. As shown in the comparison analysis, heavy bomber and ICBM deployment bases under the proposed action may experience reductions in air and noise emissions, hazardous waste generation, risk to human health and safety, and employment, while the adverse environmental effects at storage, conversion or elimination facilities may increase.

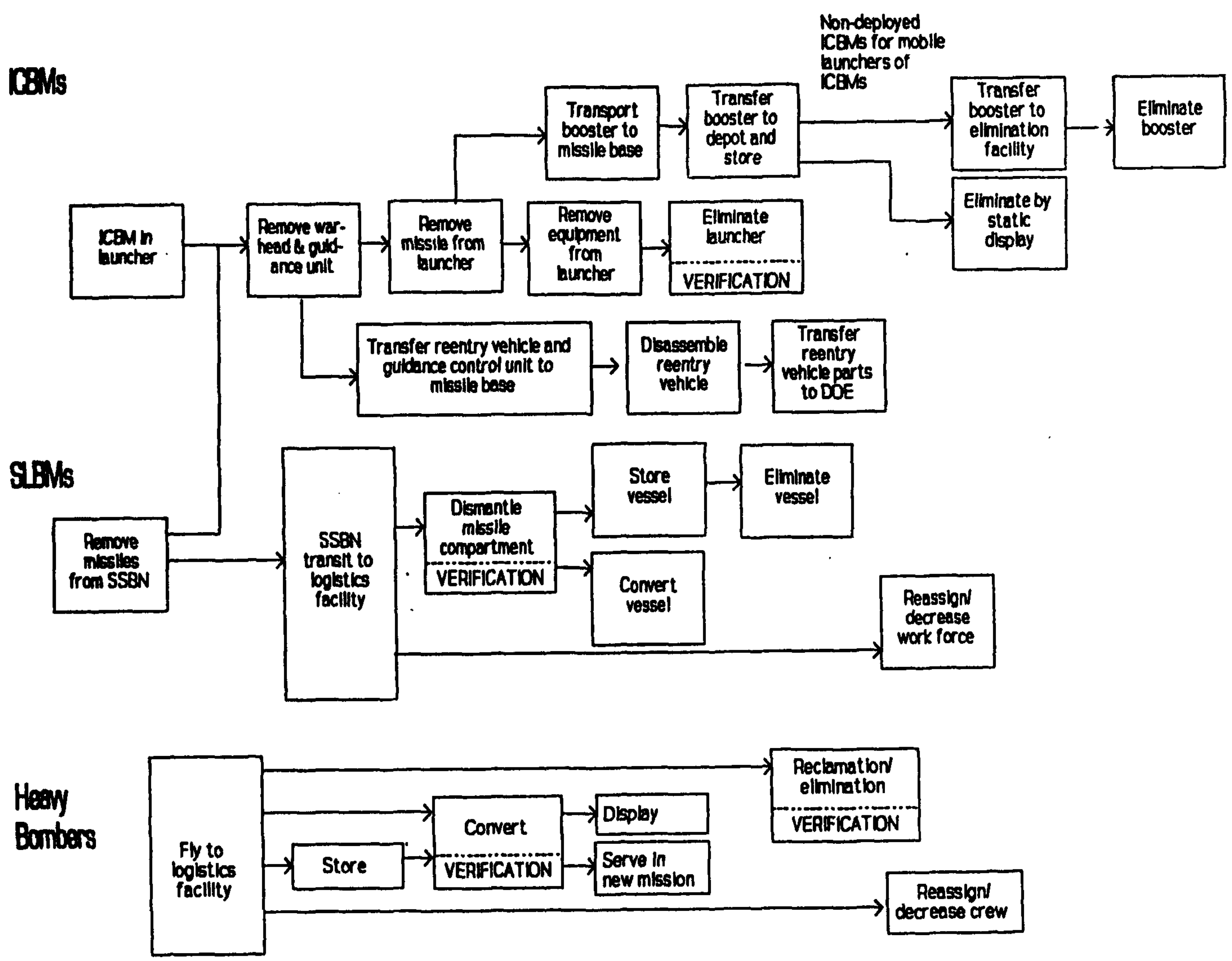
Whether the Treaty is ratified or not, current Navy plans for storage, conversion, retirement, and elimination of strategic offensive arms are consistent with Treaty reduction requirements. The means of implementing either alternative are identical; the environmental impacts of either alternative are also identical. Because the environment of the areas to be affected by SSBN activities will not change as a result of the proposed action, no discussion of baseline conditions of Navy locations is presented is Chapter 3. The affected environment and environmental consequences of SSBN activities have been discussed in previous environmental documents. A list of these documents is provided in Appendix A.

The planning and programming processes of Treaty-directed activities has included the publication of environmental documents to assess environmental consequences and to discuss potential mitigative measures. The likely activities involving some of the Air Force weapons systems have previously been evaluated in environmental documents. Certain Air Force weapon systems, the ICBM launchers, for example, have not been assessed for environmental impacts concerning retirement; therefore, further environmental documentation tiered from this LEIS will be prepared. If scheduled for deactivation as a result of the Treaty, systems that have not been evaluated for environmental impacts of storage, conversion, or elimination may be evaluated sooner than under the no action alternative.

### 2.3.3 COMPARISON OF TREATY IMPLEMENTATION METHODS

This section focuses on possible methods that could be implemented to attain reductions in the number of deployed, strategic offensive arms and their associated launchers. Strategic offensive arms include heavy bombers, missile launchers, and missiles. The discussion is based on unclassified information and provides no reference to the numbers or combinations of arms to be removed from deployed status as part of the Treaty. Additionally, this discussion of potential methods is intentionally broad and does not necessarily indicate which of these methods will be used. In actual implementation of the Treaty, any one, or combination of more than one, of these methods may be utilized. Such subsequent decisions will be the subject of future environmental documentation. Figure 2-2 provides a simplified overview of the major activities and alternatives within the START program.

**Figure 2-2**
**Overview of Removal of Strategic Systems from Deployed Service**



This comparison of implementation options focuses on potential environmental impacts associated with these options to assist decision-makers in the choice of a preferred method. Environmental considerations include compliance with environmental laws and regulations (e.g., RCRA, NAAQS), effects on the local and regional physical and biological environment, and potential risks to worker and public health and safety. Technical and economic considerations such as stage of development of a particular method or start-up costs influence the feasibility of potential options for implementation. Verification criteria, as outlined in the Treaty, would also determine the feasibility of alternatives. Specific procedures for conversion or elimination of heavy bombers and elimination of former heavy bombers and elimination of silo launchers of ICBMs, silo training launchers, and silo test launchers are provided in the Treaty Conversion or Elimination Protocol.

#### 2.3.3.1 Heavy Bombers

The potential methods that could be implemented to reduce the active strategic bomber inventory include: conversion to a non-strategic capability; dismantling the aircraft to make it inoperable; placing it on static display, or storing the aircraft following conversion.

##### 2.3.3.1.1 Conversion

According to the MOU, Davis-Monthan AFB would serve as the designated conversion or elimination facility for heavy bombers and former heavy bombers. Tinker AFB, OK and Kelly AFB, TX, are listed in the MOU as repair facilities but may also support the conversion/elimination of heavy bombers.

The bombers could be flown to an appropriate maintenance facility, Davis-Monthan, or the Oklahoma City Air Logistics Center (ALC) at Tinker AFB, OK, to undergo conversions. Depending on the number of aircraft that are to be converted within a specified time frame, the San Antonio ALC at Kelly AFB, TX, could also be involved. At the conversion facility, components that support the strategic mission would be removed and destroyed. This would include the wing pylons, rotary launchers, and avionics systems. The aircraft would then be physically modified with different equipment to support conventional forces such as carrying gravity bombs, stand-off munitions, naval mines, and anti-ship missiles. After the conversion is complete, the bomber would be returned to its originating base or to another base in support of a force structure change.

Increased conversion activities resulting from Treaty-related activities could result in temporary minimal impacts to the air and noise environment at the conversion facilities, increased hazardous waste generation, and potential short-term health and occupational hazards. The level of impacts resulting from conversion activities would depend primarily on the additional demand on existing aircraft maintenance/mechanical facilities above current requirements and capacities.

#### 2.3.3.1.2 Storage, Reclamation, or Elimination

The bombers would be flown to Davis-Monthan AFB for reclamation or elimination and storage. The Aerospace Maintenance and Regeneration Center (AMARC) at Davis-Monthan AFB, AZ, is the primary Air Force facility responsible for handling weapon systems after their useful life. Approximately 500 of the 2,500 acres of open space available at AMARC could be utilized for the reclamation/elimination and storage of the bombers. The aircraft would be stripped of essential equipment, and any spare parts and components that can be used for the continued support of active inventory would be retained. Aircraft stripped for elimination would require hazardous materials removal, handled under existing guidelines for proper disposal. The wings would be cut off, the fuselage cut in half, and the tail section severed from the fuselage. Because of the verification procedures, the 500-acre site would be separate from daily operations, thus requiring construction of a fence and nose docks and extension of utilities to the site.

Potential impacts from storage or reclamation/elimination would be similar to those discussed above for conversion with the addition of potential impacts to the biological, physical, and visual environments surrounding the storage facilities due to the possible construction of new storage facilities.

#### 2.3.3.1.3 Static Display

The bomber could be flown to an Air Force installation nearest to the display site, where it would be made incapable of performing its mission. Virtually all equipment and component parts would be removed, destroyed, or retained to be used for the continued support of active inventory. Aircraft stripped for static display would undergo removal and disposal of hazardous materials under existing regulations. Only the shell of the aircraft would remain for display. The Treaty allows no more than 20 heavy bombers and former heavy bombers to be placed on static display.

Potential impacts associated with the static display of bombers would include short-term occupational safety and health risks associated with handling hazardous materials and degradation of air, soil, and water quality from hazardous material disposal. These potential impacts would be insignificant because of strict Federal regulations designed to mitigate potential effects to workers and the environment from the handling and disposal of hazardous materials.

### 2.3.3.2 Missile Launchers

This section discusses the method for eliminating an ICBM launcher, commonly referred to as the silo and launch control facility.

The elimination of the ICBM delivery system would begin with a normal maintenance operation, removing the missile from each silo. A payload-transporter is used to remove

and transport the reentry vehicle and guidance system. After the reentry vehicle and guidance system are removed from a Minuteman missile, a transporter-erector (TE), a unique tractor-trailer, removes the booster from the silo and provides a controlled environment for moving the booster. Because of the large size of the Peacekeeper, a stage-transporter is used to remove and transport its stages. The transporters move the booster from the LF to the maintenance base where it would await further transport to the storage or elimination facilities.

The equipment in the adjoining support building would be shut down and dismantled, and all coolants, fuels, hydraulic fluids, etc. drained and disposed of in accordance with any applicable regulatory requirements. Any hazardous substances, such as asbestos and PCBs, would be handled in accordance with all applicable Federal, state, and local requirements. The conduit connecting the equipment with the silo would be cut and removed.

The elimination of the silo (or LF) would involve either drilling holes, placing explosives, and blasting six meters or more of the headworks or excavating to a depth of no less than 8 meters. The blasting would be engineered so the majority of concrete debris would fall into and fill the silo. A concrete plug may be used to cap off the debris. After the verification procedure is complete, any remains of the silo above the concrete debris or cap would be backfilled with dirt to approximate the surrounding contour. Any remaining concrete slabs and appurtenances would be bulldozed or blown up, then salvaged by the contractor or disposed of in an approved landfill. Any asbestos insulation within the silos would be handled according to applicable regulations. The security fence may be the last item removed from the site.

At the LCF, the weapon system computers and any reusable equipment would be removed from the LCC and support buildings. Any asbestos in the buildings would be handled and disposed of appropriately. All fluids and fuels would be drained and disposed of in accordance with regulatory requirements prior to the removal of any equipment and tanks. Underground storage tanks (USTs) that are not reusable would be removed and disposed of in an approved landfill, and environmental restoration of any fuel leakage from the USTs would occur. The access doors to the LCC and support building would be blocked and the elevator shaft filled with concrete. The sewage lagoon would be closed, and environmental restoration would occur. The above-ground building may be razed or demolished, placed in caretaker status, utilized for other DOD missions or systems, or sold.

Environmental restoration could take several years in order to comply with current state and Federal statutory and regulatory environmental requirements such as the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), the National Contingency Plan (NCP), and the Resource Conservation and Recovery Act (RCRA) and the myriad of similar, but varied, state requirements.

The land at the LF and those LCFs to be demolished would be returned as close as possible to preexisting conditions. The government may retain the use of the land at some sites for possible future systems, with the remaining sites being returned to private sector use. The elimination process for launch canisters of ICBMs for mobile launchers of ICBMs requires the body of the launch canisters to be crushed, flattened, or destroyed by explosion. The U.S. has one test launcher for rail-mobile Peacekeepers which would not be required to be eliminated based on Treaty limits.

### 2.3.3.3 Missiles

During the deactivation process, the missile is "disarmed," i.e., disconnected from all firing circuits such that it cannot ignite and fire. Following highly-structured safety procedures, a specially-trained team removes the assembly containing the warheads. These are placed in special, highly-armored shipping containers and returned to the host AFB or designated SSBN base for transfer to the Department of Energy (DOE). The remaining booster is then disassembled into its stages, each of which can also be termed a rocket or missile motor. The Minuteman II and III booster can be shipped as a whole or with all three stages separated. Igniter assemblies are removed, and each motor is then placed in a special case-like shipping container.

Methods of reducing the active inventory of boosters are described in the following sections. Because the main stages of the missiles currently deployed contain solid fuel, the methods which could be used to reduce the active inventory would be substantially the same for any of these types of missiles.

The Treaty does not limit non-deployed missiles (except mobile ICBMs) and does not actually require the US to destroy any missile boosters. However, options for maintaining or reducing the subsequently increased rocket motor inventory from ICBMs taken out of deployment requires evaluation. The recommendation or determination of the method is beyond the scope of this analysis. The following discussion of methods to maintain or reduce the inventory of boosters includes storage, static fire, open detonation, ongoing and developing technologies for the removal and treatment of propellant, and conversion. The environmental impacts of these options are discussed in more detail in Chapter 4. The methods applicable to Treaty-accountable boosters include storage, static display, and elimination and propellant removal methods. The elimination and propellant removal methods are applicable to boosters of ICBMs for mobile launchers of ICBMs (i.e., Peacekeepers).

#### 2.3.3.3.1 Storage

Storage of rocket motors could be a short-term and/or long-term method of complying with the terms of the Treaty. After the missiles are removed from launchers, they would be placed in special containers and transported by air, road, or rail to maintenance or contractor facilities. Recently, it was discovered that the transport of MM size rocket

motors by C-141s caused stress on the wings of the aircraft. Military Airlift Command (MAC) expects refurbishment of the C-141s to accommodate MM size rocket motors to be complete by the end of the 1991 calendar year. Most missile motors would be transported to and stored in the interim at Hill AFB. Some missile motors would be stored in storage buildings at Tekoi, Goshute Indian Reservation and the Oasis site near Hill AFB. The storage buildings at Oasis are not earth-covered. At the storage facility, the missile motors are removed from the shipping containers and are placed in earth-covered storage buildings (often referred to as "igloos") under climate-controlled conditions to delay degradation of solid propellant. The storage structures are situated to comply with quantity-distance regulations to minimize the remote possibility of an accident causing a chain-reaction.

The SLBMS are removed from the SSBN at one of the designated SSBN bases. The SLBM is transported by road to missile storage or production facilities at the same base. The warheads are removed and the missile disassembled at the base. The warheads are returned to DOE storage facilities. The missile components are either stored at that base or transferred by road or rail to another designated SSBN base.

The potential environmental impacts of storage in existing facilities would be negligible. If construction of new storage buildings is required, effects on both the physical and biological environment would occur. Many of the construction impacts such as degraded water quality from site runoff or air quality degradation from increased particulate (fugitive dust) and construction equipment emissions would be short-term.

#### 2.3.3.3.2 Static Display

One method of handling some missiles removed from deployment would be to place the missile casing on static display in a museum. All propellant and explosive parts could be removed from the missile motor, leaving only the empty casing for display. Missiles placed on static display would require removal of hazardous materials, and these materials would have to be properly disposed. The Treaty allows no more than 20 ICBM and SLBM launchers and 20 ICBMs and SLBMs to be placed on static display.

#### 2.3.3.3.3 Elimination of Missile Motors

The missile motors potentially affected by the Treaty contain solid fuel. Any liquid fuel in the SCDM of the Peacekeeper can be recovered and reused. The elimination methods discussed below are applicable to Treaty-accountable boosters of ICBMs for mobile launchers of ICBMs but could also be used to eliminate retired boosters. The solid fuel in the interior of the missile motor is composed of a single piece of rubber-like material. A central cavity runs down most of the length of the motor. The fuel is "cast" into the casing during manufacture. Once it cures, it solidifies and bonds to the casing.

The US Army Armament, Munitions and Chemical Command (AMCCOM) completed a study in June, 1990 on demilitarization alternatives to open burning/open detonation (27). The study evaluates the current, emerging, and conceptual technologies used for reducing, treating, and eliminating military waste, including propellant from missile rocket motors. The Joint Army-Navy-NASA-Air Force (JANNAF) Safety and Environmental Protection Subcommittee recently conducted a workshop on "Alternatives to Open Burning/Open Detonation of Propellants and Explosives" that addressed topics similar to the AMCCOM study.

There are two basic options to disassemble or destroy a rocket motor: burn the fuel in the motor, or remove the fuel followed by possible treatment to reclaim or dispose of the fuel. The following sections describe only existing and emerging technologies for implementing these potential options.

The Treaty requires rocket nozzles, motor cases, as well as the interstage skirts of a missile (ICBM for mobile launcher) remaining after propellant removal, static fire, or open detonation, to be crushed, flattened, cut into two pieces of approximately equal size, or destroyed by explosion, and the SCDM as well as the front section, including the reentry vehicle platform and the front section shroud, to be crushed, flattened, cut into two pieces of approximately equal size, or destroyed by explosion.

Static Fire

In the 25 years since solid-fueled rockets have been in use, two methods have been used to burn unwanted propellant directly out of a motor casing. These methods are termed open detonation and static fire.

The static fire method is routinely used in the testing of new types of motors and for life-cycle testing to check on the aging of motors in service. When used for the purpose of removing the propellant, the static fire method involves none of the instrumentation used in a testing program. Instead, a motor is fastened to a well-anchored stand, and the motor is burned through the nozzle as it was designed. Through visual inspection of aging motors, a determination can be made that a motor has flaws, preventing static firing. Motors with flaws are disposed of through open detonation or propellant removal as described in the following section. The inspection process also includes X-ray viewing to identify flaws not seen during visual inspections.

Static firing of rocket motors is a current technology for elimination of Pershing I and II motors, and for testing of numerous other rocket motors, including those used to launch space shuttles. Thus far, this method has allowed for compliance with current Federal and state laws and regulations, but has become the subject of increased public scrutiny because of potential health effects related to HCl and $AL_2O_3$ emissions. For example, at the John C. Stennis Space Center in Mississippi, a recently-formed citizens group has vigorously opposed the static testing of NASA's Advanced Solid Rocket Motor (ASRM)

(9). Although one ASRM is nearly equivalent to 100 MM II Stage 2 motors, the types of emissions are similar: 21% HCl, 36% $Al_2O_3$, 24% carbon oxides.

Static firing allows for high burn temperatures (approaching 6000°F), which causes conversion of most of the CO to $CO_2$ in the presence of oxygen. The high temperatures also cause rapid plume rise, and therefore, rapid dispersion of emissions. Static firing causes minor soil disturbances, and ash residues may be safely disposed of in a RCRA-permitted landfill if the ash meets the land disposal restriction requirements of 40 CFR Part 268. When performed under proper meteorological conditions and in accordance with the Clean Air Act and RCRA, the likelihood of ground or surface water contamination from emission products and/or post-firing residues is slight. If static fire is performed strictly for elimination purposes (without test instrumentation), the process falls under RCRA permitting requirements at 40 CFR Part 270. Relevant state regulations and RCRA make it very difficult and time-consuming to obtain the necessary permits. Benefits of the static fire method of elimination include low likelihood of major worker injuries and low start-up and operating costs.

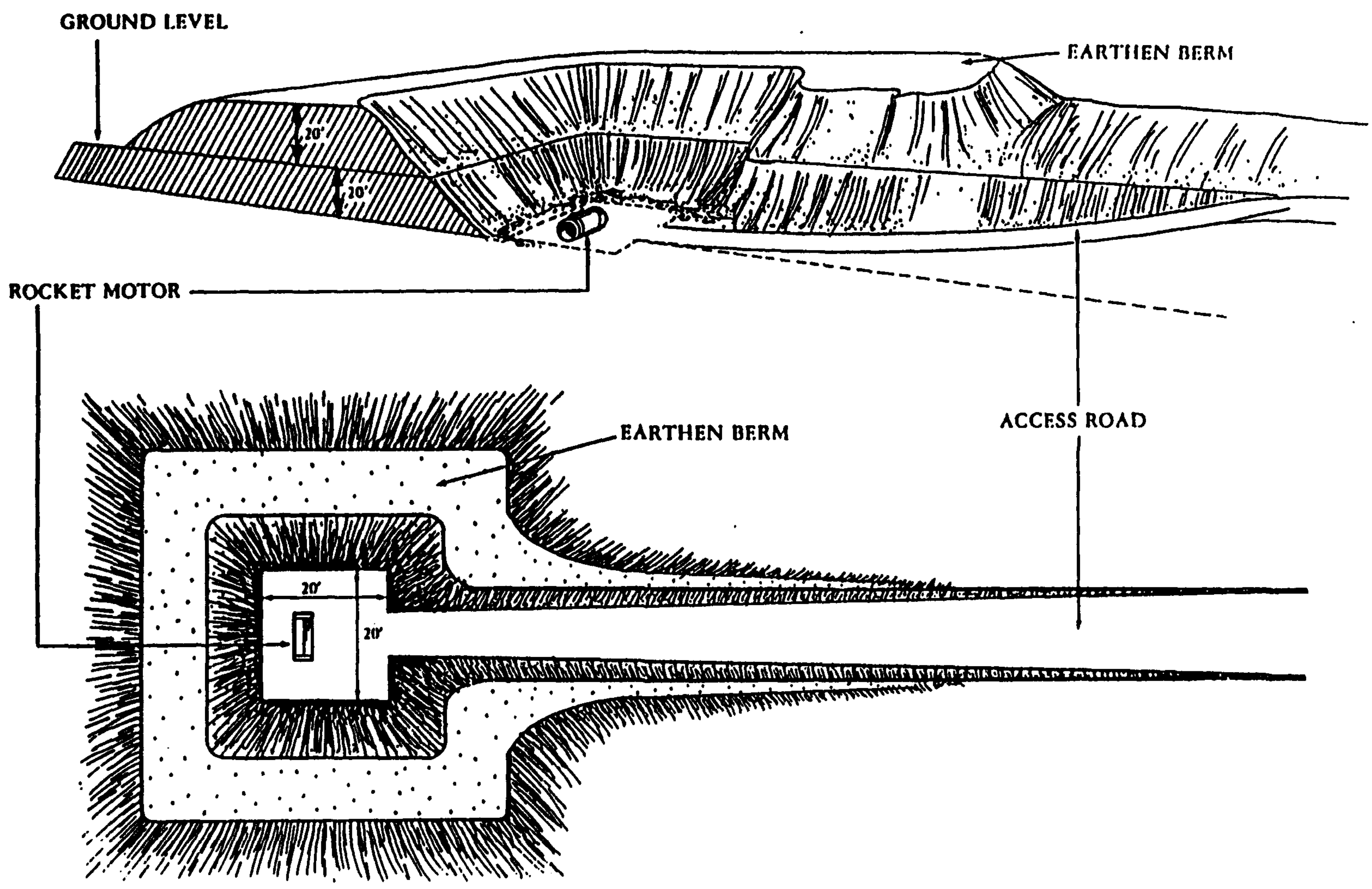
Scrubbing of the plume either by injecting alkaline water into the plume or by capturing the plume in an enclosure and releasing it through a scrubber chamber are potentially feasible mitigating concepts. If current research in plume scrubbing leads to the development of a facility capable of handling large rocket motors, then a major point of contention for static firing operations (air emissions) could be resolved. The treatment of water contaminated with scrubbing residue would be the major environmental concern with the plume scrubbing technique.

Open Detonation

Open detonation is currently used for the elimination of class 1.3 motors that are unreliable and degraded and is also the most common method of eliminating class 1.1 rocket motors. In order to mitigate effects on the environment, controlled burning (i.e. only when meteorological conditions are favorable for rapid dispersion of pollutants and restrictions on the quantity of propellant that can be burned over a specified time period) and lined burn pits are recent improvements to this fifty-year-old technology.

During open detonation, the rocket motor is placed on its side in an earthen pit, as shown in Figure 2-3. The nozzle(s) will be destroyed in accordance with conversion/elimination protocol. In areas where the water-table is shallow, a metal cage with a clay-lined pan has also been used to open detonate rocket motors (7). A strip of explosive, attached along the length of the motor, is detonated. For motors with class 1.3 propellant, this ruptures the case lengthwise and ignites the propellant, which then burns for a number of minutes. The burn time is variable and is dependent on the size of the motor and the extent of the rupturing. For motors with class 1.1 propellant, a sufficient explosive charge is used to detonate the entire motor.

**Figure 2-3**
**Conceptual Design of an Open Detonation Pit**




Based on Figure 2-3 from the INF EA (DoD, 1988)

Ground-level pollution tends to be more concentrated in the elimination area than for static firing, and can include higher proportions of CO. Depending on the constituents of the motor casing, compounds such as cyanide and asbestos can be dispersed from open detonation. Regulations at 40 CFR Section 260-270 (specifically, Part 264, Subpart X) and applicable state regulations apply to open detonation, as well as static firing for elimination, and make it very difficult and time-consuming to obtain the necessary RCRA permit and other permits. Subpart X units (i.e., open detonation) are actively permitted under Section 3004 of RCRA. The statute requires these types of units to receive permits by November 8, 1992. Air quality degradation, soil disturbance, potential ground and surface water contamination, and scattered propellant and residue comprise the environmental concerns associated with this method. Although small crew requirements, low facility capital investment, low upkeep cost, and overall low operational cost make this alternative appear the most economically feasible, the cost and time involved in obtaining permits and reclaiming the burning grounds must also be considered.

While open detonation and static fire appear to be the easiest methods of destruction, in fact, they appear to be the most environmentally damaging due to the potentially large amounts of pollutants which would be discharged into the air. Because of strict RCRA and Air permitting requirements under both Federal and State law, absent obtaining a Presidential waiver of the RCRA and Clean Air Act requirements, these methods are likely to be among the most difficult to accomplish.

Other Missile Motor Elimination Methods

A number of other theoretically possible methods exist to remove or eliminate missile motors, but are not considered reasonable alternatives. These concepts include simple burial of the intact motors on land, perhaps after filling or encasing them in concrete, or ocean dumping with possible underwater ignition. Land disposal or ocean dumping of such hazardous material would be contrary to Federal government policy regulations.

#### 2.3.3.3.4 Propellant Removal Methods

Instead of burning the rocket fuel in the casing, as described in the previous sections discussing static fire and open detonation, there are several techniques in various stages of development for removing the propellant from the casing. The Treaty only requires propellant elimination of ICBMs for mobile launchers of ICBMs, Peacekeepers, in the event the US chooses to reduce the number of this type of ICBM. Once the propellant is removed, the components or ingredients could then be treated for the purpose of reclamation or incineration. The following sections describe the principal methods under development and are based on the information currently available.

## Water Jet Washout

The washout method, used for over twenty years on class 1.3 propellant only, utilizes high pressure jets of water to wash and cut the propellant out of the intact casing. The slurry may be separated to remove the solid aluminum powder and the rubber from the dissolved AP for reclamation purposes. The solids are packaged in shipping containers and the AP solution is directed to a discharge basin. The wastewater can be evaporated to the atmosphere, the slurry and solids can be incinerated or burned in open pit, and the AP can be reclaimed. This method is not suitable for class 1.1 propellants because of safety concerns.

Aerojet and Thiokol Corporations utilize washout processes to remove propellant from motor casings. This is a proven technology for the first and second stage of the Minuteman booster. Hazardous emissions do not result from this procedure except in the rare event of accidental propellant ignition, which has been known to occur during the process. Because slurry and solids may be burned in an open pit, this alternative consequently would involve many of the considerations mentioned previously for open detonation such as air quality degradation, ground disturbances, and potential soil, surface, and ground water contamination. Washout methods involve higher start-up, maintenance, and subsequent treatment costs than static fire. Currently, there are no facilities capable of washing out all missile motor types to be removed from the active inventory due to Treaty implementation. If this method should prove to be a viable method of propellant removal, site-specific, "tiered" environmental documents will have to be prepared.

## Cryogenic Fracturing

Cryogenic fracturing is another technique used to remove propellant from rocket motors. Supercooling the motors in liquid nitrogen embrittles both the casing and the propellant, causing them to shatter into small pieces when compressed. These pieces could be fed to an incinerator for elimination. Cryogenic fracturing, or "cryofracturing," has been demonstrated on a much smaller scale (1-2 pounds of propellant) than would be needed for ballistic missile motors, and its feasibility on a large scale is not known. This method is also in the experimental stage and more specific environmental analysis of this method will also be done in site-specific, "tiered" environmental documents, as appropriate.

## Mechanical Cutting

Similarly, mechanical cutting of casing and propellant has been demonstrated on a scale for rocket motors and munitions much smaller than ICBM motors. The technical feasibility and safety of this method for ballistic missile motors is also not known. If this method of propellant removal should prove to be a viable method of propellant removal, more specific environmental analysis will be done in site-specific, "tiered" environmental documents.

Critical Fluid Extraction

Critical fluid extraction may use different solvents, i.e., ammonia or carbon dioxide, to "dissolve" and remove both 1.1 and 1.3 propellant from the motor case and could be used to selectively recover some ingredients. The residue not reclaimed would still require disposal using conventional methods or application of new technology. This is an unproven technology for large rocket motors and is not considered a viable method at this time. Should this become a viable method within the time-frame of the Treaty, further site-specific analysis would be needed before implementation.

### 2.3.3.3.5 Treatment Methods Following Removal of Propellant

Once the propellant has been removed from the motor casing, it can be either incinerated or reclaimed.

Propellant Incineration

Several incinerator designs are in use in DOD and related facilities for disposing of various types of "energetic materials," including propellants. Most designs require dry chunks of propellant; one design intended to handle a propellant slurry has not proven reliable. None of these incinerators were designed to accommodate either large pieces of propellant (five pounds is the nominal size) or high volumes, such as might be needed to dispose of Treaty-related missile motors typically exceeding 5,000 to 10,000 pounds.

Prior to elimination, propellant must be removed from the motor casing and cut into suitable sizes to be fed into the incinerators. Any additional handling, pretreatment, cutting, or post treatment creates additional cost and safety considerations. Emissions are more easily scrubbed than in the static fire alternative, but HCl and $Cl^-$ corrosion problems in the scrubber could lead to higher maintenance costs. With incinerator scrubbing, environmental compliance with air emission limitations could be achievable. The incineration procedure requires a small operating crew, primarily responsible for controlling the fuel rate. Although greater emission control is achieved with this elimination alternative, feed rate limitation, pretreatment costs and risks, low economic feasibility, concern for elimination and treatment of ash residue, and contaminated scrubbing material are limiting factors for the large volume of propellant that could be processed.

Propellant/Ingredient Reclamation

The USAF funded the operation of a pilot plant for recovery of AP from propellant. Using jets of hot water to cut the propellant and dissolve the AP, followed by cooling of the water, this plant demonstrated the technological feasibility of recrystallizing and recovering usable AP from propellant.

The technology for AP recovery has been demonstrated on a pilot plant scale (150 lbs per hour) for solid propellants, and minimal environmental impacts would occur from the process if a plant of sufficient capacity were to be constructed. The hot water used to extract the AP is cooled to crystallize the AP and can then be reused. Conceptually, the AP could be used in fresh propellant, or the AP could be transformed into other products, such as calcium hypochlorite [$Ca(OCl)_2$], although the economic viability of reuse was not demonstrated. This closed system has the benefit of not generating an uncontrolled waste stream. Other missile propellant constituents are shown in Table 2-1 (excluding the MMIII PBCS and Peacekeeper SCDM) and represent 30% of the waste propellant. These remaining wastes would have to be disposed of according to applicable Federal, state, and local regulations. Reclamation involves considerable handling of propellant, which generates a concern for safety. This process also generates hydrogen, causing additional safety concerns. Large scale reclamation could be difficult to accomplish safely.

Water Oxidation

Supercritical water oxidation is a high temperature, high pressure process that could theoretically completely oxidize both class 1.1 and 1.3 propellants. No ingredients are reclaimed, and some by-products are produced. The propellant must first be removed from the motor and ground to a powder before processing.

This is an unproven technology for large rocket motors and is not considered a viable method at this time. Potential advantages of this technology include: no dependency on weather conditions for implementation; minimal emissions; potentially less expense than incineration; low operating temperatures; enclosed system; and capability to treat Class 1.1 propellants.

Other Propellant Treatment Methods

Biodegradation and ultraviolet degradation are developing technologies that are yet to be proven on a large scale. These are not considered viable methods at this time. However, biological treatment appears to have the greatest potential for accomplishing degradation of liquid-based propellant in an economical, environmentally safe manner in a wide variety of environments. Microbial degradation methods are currently being used for the disposal of various organic compounds (including explosives), and these processes are gaining wide acceptance. Available biological treatment systems that may be applicable for the degradation of liquid propellants include composting, aerobic bioreactor, rotating biological contactor, fluidized bed reactor, and trickling filter treatment (29).

### 2.3.3.3.6 Conversion of Retired Missiles

The conversion of a missile for research and development, or for use in the small satellite launch field, would involve modifying the guidance electronics package and fabricating

and installing new payload fairings and fittings. As an example, a first stage of a MM may be used as a one-stage vehicle for carrying research payloads on suborbital flights. The missile motor itself would not be modified but could be fitted with a specially-built payload vehicle instead of a second stage. In the past, missiles that have been superseded by newer models have been used as targets for Strategic Defense Initiative (SDI) tests. Non-deployed rocket motors resulting from the Treaty could also be used for SDI research.

The conversion of a missile involves safety considerations, launch impacts, and potential construction impacts. If new R&D facilities are constructed under this implementation option, then impacts to the physical and biological environments could occur. Launching of converted missiles would result in air emissions with subsequent impacts on the environment. If launching of converted missiles results in an accelerated launch rate, the likelihood of an accident at a launch site would increase.

#### 2.3.3.3.7 Launch to Destruct

Launch to Destruct is a potential elimination method for ICBMs. This method would require removing the reentry vehicles, transporting the rocket motors to an established space and test launch center, and launching the missile over the ocean. As with all launches from US-operated test ranges, the missiles would have a "destruct" package aboard that would destroy the missile in flight if necessary for safety reasons.

This option is logistically problematic and cost prohibitive for even a small number of launches and provides potentially significant adverse environmental impacts, specifically air quality impacts, from launching a large number of rocket motors. Because of the need for range support functions and range time, this is a costly alternative. Limits on available launch time because of higher priority use of range facilities would constrain the number of launches. Availability of required safety kits to destroy the missile in flight if necessary would impose additional constraints on the viability of this alternative for a large number of rocket motors. For ICBMs for mobile launchers of ICBMs, recovery of the rocket nozzles, motor cases, interstage skirts, and self-contained dispensing mechanism would be required followed by elimination as specified in the Treaty Conversion and Elimination Protocol. Because this alternative in not considered viable, it is not evaluated further.

#### 2.3.3.3.8 Summary

In summary, no method for reducing the inventory of non-deployed Treaty-accountable and retired missile motors is both technically feasible and fully free of environmental impacts. Past experiences, under implementation of the INF Treaty, have determined that static firing of Pershing rocket motors has posed minimal harm to the natural environment through mitigation and operating constraints, but concern over the effects of HCl and $Al_2O_3$ on both the natural environment and human health and safety remain, and are increasing in various regulatory and public communities. The difficult and time-

consuming process of obtaining permits for static fire and open detonation operations make these very difficult options for implementing the Treaty. Storage is an option that is feasible for most boosters taken out of deployment and would result in negligible impacts on the environment. Storage is not a Treaty-allowable option for non-deployed ICBMs for mobile launchers of ICBMs. Construction of any new facilities would result in potential, temporary adverse impacts, while operational impacts would be negligible.

#### 2.3.3.4 Warheads

The Treaty does not require elimination of warheads. The Department of Defense handles the transport of warheads between DOD facilities. Following DOD retirement of a warhead, DOE assumes responsibility for transportation. In general, within the continental US, nuclear warheads are moved by road using DOE-owned-and-operated, safe secure transport (SST) to locations such as Pantex near Amarillo, Texas, or Savannah River near Aiken, South Carolina, for dismantlement. Disassembly of the warhead occurs in a sequential fashion. First, the nuclear package is removed from the outer delivery shell. Next, the nuclear package is disassembled and the non-nuclear high explosive is removed. Nuclear portions of the device are then transported by SST to either an interim DOE staging area or to another location for final disassembly and recovery of fissionable materials. Interim staging sites include Pantex and Kirtland AFB in Albuquerque, New Mexico. Final disassembly sites include Rocky Flats near Denver, Colorado, and Y-12 near Oak Ridge, Tennessee. The proposed action may require DOE to plan and implement a larger-scale program of warhead transportation and staging.

Warheads are scheduled for return to DOE in accordance with the provisions contained in AFR 136-2, the Logistics Movement and Handling of Nuclear Cargo. Once returned to DOE, the warhead will be disposed of per internal DOE procedures at a rate consistent with the Presidential Stockpile Memorandum.

## 3.0 AFFECTED ENVIRONMENT

This chapter presents a description of the natural and man-made environment likely to be affected by one or more of the alternative methods for implementing the proposed action. For each resource category, definitions of the resource and applicable regulatory setting are presented. This chapter summarizes existing conditions in resource areas that could be affected by the Treaty. The information, presented generically or geographically, was compiled from existing documents and data.

A regulatory setting for each resource area presents an overview of Federal laws and regulations that may be applicable to the proposed action. Applicable local or county regulatory requirements are not identified because the specific site locations for the proposed action have not yet been determined. Depending on the specifics of the Treaty, compliance with additional (or fewer) regulations may be required. Because new laws may be enacted, or existing laws may be modified in the near future, modifications to planned compliance actions may become necessary. For example, the recent amendments (November 1990) to the Clean Air Act require more stringent control over air pollutant emission sources. In addition, new regulations may become applicable during the action or an unexpected discovery at the site, such as the presence of an endangered plant of animal, may require compliance with a specific law (e.g., the Endangered Species Act).

Based on a review of the environmental consequences of past practices (INF Treaty, aircraft withdrawals, and force structure and mission changes) and current operational activities, it can be reasonably concluded that no impacts will occur within some of the resource categories at potential locations. Therefore, in keeping with CEQ guidance to provide analytic, not encyclopedic documents [40 CFR 1502.2(a)], descriptions of those unaffected resources for those locations are not presented. For example, the geological, cultural, and visual resources will be unaffected at the heavy bomber deployment bases. The analyses that determined which resources would or would not be affected are presented in section 4.0, in Figures 4-3 through 4-7.

## 3.1 AIR QUALITY

Resource Definition. Air quality in a given location is described by the concentration of various pollutants in the atmosphere. The pollutants in question are in two physical forms, gases (vapors) and particulates. The physical form impacts the environmental fate of a material. Pollutant concentrations are generally expressed either in parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). The factors that affect air quality are pollutant types, emission rates and parameters, topographic features, the cumulative effect of other emission sources, chemical reactions, and meteorological conditions. The meteorological parameters that most affect pollutant dispersion are wind speed, wind direction, atmospheric stability, mixing height, temperature, and relative humidity.

Statutory and Regulatory Setting. The Clean Air Act (42 USC 7401 et seq.), as amended (40 CFR 50-53, 58, 60-61, and 124), requires that sources of air-pollutant emissions on private and federal land comply with the air quality regulations and standards that have been established by federal, state, and county regulatory agencies. These regulations establish maximum allowable emission rates and the maximum allowable pollutant concentrations resulting from cumulative emissions in an area. The Clean Air Act specifically provides for the following:

The National Ambient Air Quality Standards (NAAQS) (40 CFR 50) are intended to give the public an adequate margin of safety for protection from adverse health and welfare effects due to exposure to various pollutants. The standards are divided into two categories: primary and secondary. Primary standards provide for the protection of the health of the public and sensitive subgroups, whereas secondary standards provide for the protection of public welfare from materials soiling, vegetation damage, and visibility impairment. The averaging periods for the NAAQS range from one hour to one year. Pollutant levels are not to exceed the standards with short-term averaging times (less than 24 hours) more than once per year, and are never to exceed the long-term standards. State regulatory agencies can implement stricter standards than the NAAQS to further improve air quality. Generally, state and local agencies exempt temporary emissions, such as those due to construction activities, from regulatory review but require permits for some stationary air polluting facilities and equipment. The siting, construction, and operation of an activity or facility can be greatly influenced by permit requirements.

The National Emission Standards for Hazardous Air Pollutants sets emission limitations on new and existing sources which emit hazardous pollutants. A hazardous air pollutant is one that might reasonably be anticipated to cause an increase in deaths or serious, incapacitating illness. Asbestos, mercury, beryllium, vinyl chloride, and benzene are regulated by the US EPA. Because hazardous pollutants pose an immediate health threat, emissions must be limited to the lowest possible level.

The Prevention of Significant Deterioration (PSD) Regulations (40 CFR 52.21) define air quality levels that cannot be exceeded by major stationary emission sources in specified

geographical areas. Major stationary sources are usually sources that emit over 100 tons per year of a specific pollutant. PSD regulations establish limits on the increments of sulfur dioxide ($SO_2$) and total suspended particulates (TSP) that may be emitted above a pre-measured amount in each of three class areas. Class I areas are pristine regions, which include national parks and wilderness areas. All other areas in the US are classified as Class II, where moderate, well-controlled industrial growth could be permitted. There are no areas in the US currently categorized as Class III (specially designated industrial areas).

The State Implementation Plan (SIP) requires a state to outline a policy by which affected areas can reduce emissions, improve air quality, and regain attainment status. States, in turn, require affected counties to develop air quality attainment or maintenance plans.

The Resource Conservation and Recovery Act (RCRA), via 40 CFR 264.601, requires facilities to prevent any release that may have an adverse effect on human health and the environment including the disposal of gases, aerosols, and particulates, and to control hazardous constituents.

### 3.1.1 HEAVY BOMBER DEPLOYMENT BASES

The deployment bases (see Figure 2-1) represent most of the climatic zones across the country, including moderate temperatures with low humidity, hot and humid, rainy, and semiarid conditions. Annual precipitation ranges from 26 to 44 inches, and snowfall from virtually nothing to 41 inches per year.

Atmospheric effects from nearby mountain ranges with near pristine air quality help to vent air pollutants at bases near mountain regions. An exception, Castle AFB, is located in a valley where thermal inversion hinders the dissipation of pollutants. Those bases in the northern US tend to be in rural areas with overall good air quality.

Hydrocarbons (HC), carbon monoxide (CO), nitrogen oxides (NOx), particulate matter (PM), and sulfur oxides ($SO_x$) from aircraft emissions contribute to the level of criteria pollutants at these facilities. Few sources of pollutants exist in the regions surrounding the majority of the deployment bases, thus most of the locations are in attainment for criteria pollutants. However, a few bases are in non-attainment for ozone ($O_3$), CO, and TSP because of their close proximity to a metropolitan area which is in non-attainment.

### 3.1.2 ICBM DEPLOYMENT BASES

The ICBM bases and launch sites are located in sparsely populated, rural areas of the midwest and northern great plains regions. Current Air Force operation and maintenance activities have not adversely affected the air quality in the regions, and the air quality is good for all deployment sites.

Atmospheric effects from nearby mountain ranges with near-pristine air quality help to vent the few air pollutants at three of the deployment bases: Malmstrom, F.E. Warren, and Ellsworth. The visual limits for five of the bases range from 45-85 miles, with Whiteman AFB ranging from 17-20 miles due to the rolling topography of the region.

Few point sources of air pollutants exist in any of the deployment sites. Class I PSD areas exist within fifty miles of Ellsworth and Malmstrom AFBs. Whiteman AFB is listed as unclassified according to the NAAQS, with the remaining five bases listed as being in attainment status.

The climate surrounding the six ICBM bases ranges from moderate, with low humidity, to semiarid. Climatic extremes are the norm for most of the areas, with annual precipitation ranges from 15 to 42 inches and snowfall from 25 to 58 inches.

### 3.1.3 HEAVY BOMBER STORAGE, CONVERSION, OR ELIMINATION FACILITIES

The potential storage, conversion, or elimination facilities for heavy bombers, Davis-Monthan, Tinker, and Kelly AFBs, located in Arizona, Oklahoma, and Texas respectively, exhibit similar annual average temperatures of 61°-68°F and prevailing winds of 10-13 mph, but differ in precipitation totals. Davis-Monthan AFB averages 10 inches per year while Tinker AFB averages 33 inches and Kelly averages 29 inches per year.

The pollutants emitted by aircraft include those identified in Section 3.1.1. Volatile organic compounds (VOCs) are also emitted at these facilities during current paint stripping, painting, and other aircraft maintenance activities. The Air Quality Control Regions in which Davis-Monthan and Tinker are located fail to meet the NAAQS for CO, and Davis-Monthan AFB is also in non-attainment for TSP. Kelly AFB is in attainment with all Federal and State standards. Air quality regulations pertaining to three Class I PSD areas in the vicinity of Davis-Monthan AFB limit the degradation of ambient air quality.

### 3.1.4 MISSILE STORAGE, CONVERSION, OR ELIMINATION FACILITIES

The facilities that are capable of launching converted boosters for commercial launch purposes include Cape Canaveral and Vandenberg, which are located in coastal environments yet differ in climatic conditions. Vandenberg is dry and subtropical while Cape Canaveral is wetter with higher humidity. Precipitation other than rain is negligible. Other than periods of persistent subsidence inversion trapping pollutants during the summer at Vandenberg, both locations are in attainment areas for the NAAQS. Launch activities are currently on-going at both sites.

The other potential storage, conversion, or elimination sites are in attainment status for all the criteria pollutants, with some adjacent metropolitan areas in non-attainment for TSP and $O_3$. Air quality at a few of the potential sites is affected by diurnal temperature fluctuations and nocturnal inversions. Meteorological conditions vary considerably ranging

from warm, humid summers and mild winters at Longhorn Army Ammunition Plant (AAP) to drier, milder summers and below freezing winters at Hill AFB. All of the potential sites, except Longhorn AAP, have low to moderate precipitation with most falling in the form of snow at the northern locations. Average annual wind speeds are light, but dust storms may be frequent at the drier sites, resulting in increased background levels of particulates.

## 3.2 NOISE

Resource Definition. Noise is unwanted sound, generated from a wide range of sources, that interferes or interacts with the human or natural environment. There are two primary sources of noise: stationary and transient. A stationary source is generally associated with a specific land use or site such as an industrial facility, whereas transient noise sources (e.g., automobiles, missiles, and aircraft) move through an area. The human response to noise is diverse and varies with the type of noise, time of day, and sensitivity of the receptor. Noise-sensitive receptors are commonly defined as the occupants of any facility where a state of quietness is a basis for use, such as residences, hospitals, or churches. Some protected species of wildlife could also be considered noise-sensitive receptors.

Noise is described in terms of sound levels measured in decibels (dB) or decibels adjusted to an A-weighting (dBA) to correspond with the range of human hearing. Ambient noise is all noise generated in an area, including background and incidental sources. The day-night noise level ($L_{dn}$) is a noise descriptor developed by the EPA. It is an energy average of noise level throughout the 24-hour day, with a 10-dB penalty added to the nighttime noise levels between 10 p.m. and 7 a.m. The $L_{dn}$ was designed to account for the effects of background noise levels. The instantaneous noise level descriptor describes noise levels of very short durations.

Statutory and Regulatory Setting. The Noise Control Act of 1972 (42 USC 4901-4918), provides a basis for state and local governments to establish exterior noise standards for various land uses. The Act also directs Federal agencies to carry out their programs in such a manner as to minimize noise impacts on public health and welfare. The Department of Housing and Urban Development sets an $L_{dn}$ of 65 dBA as an acceptable exposure for all sources of noise except loud, impulsive sounds like sonic booms or quarry blasting. The Environmental Protection Agency (EPA) has identified 55 dBA as a desirable noise level for outdoor and residential use. Army Regulation 200-1 presents 65 $L_{dn}$ as a standard which is enforceable for all Army installations. The Air Force sets an $L_{dn}$ 65 to 70 dBA as an acceptable level for most on-base administrative and residential land-use areas.

### 3.2.1 HEAVY BOMBER DEPLOYMENT BASES

Baseline noise conditions vary with the amount of on-base aircraft operations, construction activity, and vehicular traffic on local roads and highways. The AF uses the Air Installation Compatible Use Zone (AICUZ) program to determine the compatibility of land uses with the potential hazards from aircraft noise. The runway is the focal point of base-generated noise with the area impacted generally shaped like an ellipse surrounding the runway. This ellipse may be as great as eight miles wide and 25 miles long. The type of aircraft flight activity at each base dictates how far from the runway the 65 $L_{dn}$ (maximum residential level) noise contour is located, thus the number of acres affected

by the noise. The 65 $L_{dn}$ contour is the lowest contour the AICUZ program uses. Attempts are made at each base to route vehicles and aircraft away from sensitive noise receptors such as residential areas. Noise complaints are infrequent due in large part to the bases being located in rural areas, away from major population centers.

### 3.2.2 ICBM DEPLOYMENT BASES

Baseline noise varies at the different ICBM bases depending on the level of aircraft operations, construction activity, and vehicular traffic. Four of the ICBM bases, Malmstrom, Minot, Grand Forks, and Ellsworth AFBs, support a bomber or tanker mission. The noise levels adjacent to the runway are generally greater than 80 $L_{dn}$. Of the remaining two bases, Whiteman AFB supports fewer, smaller, and/or quieter aircraft, while F.E. Warren AFB supports only helicopters, which keep the 65 $L_{dn}$ noise contours closer in to the bases, reducing the amount of land affected by base-generated noise. Whiteman AFB is in the process of preparing facilities to support the B-2 bomber with future flight operations producing higher noise levels in the vicinity of the base. Other noise levels on base, which include vehicular traffic, equipment, and construction, range from 51-71 dBA at the different locations.

Noise background levels in the rural missile deployment areas are in the 25-35 dBA range. Residential areas, on and off base, generally experience noise levels below 65 dBA. The level of noise will vary depending upon proximity to the flightline, main highways and streets, and rail spurs.

### 3.2.3 HEAVY BOMBER STORAGE, CONVERSION, OR ELIMINATION FACILITIES

The baseline noise conditions at Davis-Monthan, Tinker, and Kelly AFBs are similar to a typical bomber deployment base but vary due to the primary mission of the facilities. Flight activity and types of aircraft operations at each facility differ, producing different noise conditions. Tinker and Kelly AFBs are heavily industrialized, and Davis-Monthan AFB supports the storage and elimination of weapon systems, producing dissimilar noise conditions. With all facilities in close proximity to metropolitan areas, noise from urban, commercial activities is common.

### 3.2.4 MISSILE STORAGE, CONVERSION, OR ELIMINATION FACILITIES

Cape Canaveral Air Force Station and Vandenberg routinely launch rocket vehicles each year. Vandenberg also experiences aircraft noise. The nature of the noise associated with launching is intense, of relatively short duration, and composed predominantly of low frequencies. The noise levels vary with the size of the vehicle being launched and associated quantity of propellant. Launch noise is described using dBA for the single instantaneous noise event and $L_{dn}$ for a 24-hour average. At these facilities, activity which

produces noise is directly associated with the operation of the base, namely automobile traffic, truck traffic, aircraft landings and takeoffs at Vandenberg, and booster firings. Railroad traffic is also a significant noise source at Vandenberg.

Sonic booms generated by the space-launch vehicles occur during liftoff and reentry of suborbital and orbital stages, with the intensity of the booms being a function of vehicle size, configuration, and velocity. The sonic booms occur over the ocean and have produced no impacts to coastal areas (20).

Baseline noise at the other elimination facilities is predominantly due to static firing and open detonation of rocket motors, and open burning of munitions and other energetic materials. Static firing produces a loud, constant noise for approximately one minute while open detonation produces a sharp, initial blast followed by a much lower, inconsequential noise lasting 8-20 minutes. Historic modeling resulted in noise projections for these activities at 55 $L_{dn}$ at 1.5 miles from the site (23).

Noise-sensitive receptors are found within a ten-mile radius of all potential sites. Longhorn AAP is heavily populated within this radius; however, no noise complaints have been received in response to current elimination activities (6).

## 3.3 WATER RESOURCES

Resource Definition. This resource encompasses surface and ground water and its physical and chemical characteristics. Also described are the major users of water, including municipal, industrial, rural-domestic, and agricultural. A more detailed, quantified description of water quality at potentially affected sites will be provided as appropriate during site-specific analysis.

Statutory and Regulatory Setting. The primary law regulating surface water pollution is the Federal Clean Water Act, 33 USC 1251 et seq., as amended (33 CFR Parts 209, 320, 323-330; 40 CFR Parts 110, 112, 116, 117, 121, 122-125, 129, 133, 136, 230, 401, 402, 403, and 404). Relevant sections of the law require states to develop programs to identify and control non-point sources of pollution, including runoff, and establish and enforce water quality standards. Federal agencies must observe state and local water quality regulations. The Clean Water Act requires the EPA or Federally-authorized states to implement permit programs for regulating the discharge of pollutants to navigable waters from any point source [the National Pollutant Discharge Elimination System (NPDES)]. This Act also requires permit programs for effluent from direct discharges, discharges into publicly-owned treatment works, and the discharge of dredge and fill material into navigable waters, wetlands, and other surface water bodies.

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601 et seq., and the Solid Waste Disposal Act [Resource Conservation and Recovery Act (RCRA)], 42 USC 6901 et seq., contain provisions regarding contamination of ground water, as do various state statutes.

The Safe Drinking Water Act, as amended, 40 USC 100 et seq. (40 CFR Parts 124, 141, and 143), sets limits on concentrations of pollutants in drinking water sources.

Executive Order 11988 directs federal agencies to avoid long- and short-term adverse impacts associated with the occupancy and modification of floodplains.

### 3.3.1 HEAVY BOMBER DEPLOYMENT BASES

The surface and ground water resources vary among the deployment bases due largely to differences in physiographic locations. Some bases are located within major river drainages while others are located adjacent to prominent surface water bodies. The supply and quality of water from underlying aquifers are adequate at all locations, with differences only in the depth to ground water. The major water users also vary with location from predominantly municipal/industrial to rural/agricultural.

Some bases get their entire water supply from municipal sources. Others supplement their own well fields with water from municipal sources, while some are entirely self-supported from the base well field or a surface water source.

### 3.3.2 ICBM DEPLOYMENT BASES

All deployment bases lie within the Missouri River drainage basin. In five of the regions, the hydrologic feature is a primary river with erratic, ephemeral tributaries. The remaining site, Whiteman AFB, has many small, perennial streams and reservoirs as its hydrologic features. Surface water quality is considered good, and supply is sufficient in all regions except Grand Forks (21).

Regional bedrock aquifers provide abundant sources of ground water in all six regions. The ground water quality is good near Malmstrom and Whiteman AFBs; high in total dissolved solids (TDS) at Ellsworth AFB; highly mineralized at Minot AFB; of poor quality near Grand Forks AFB; and of variable quality near F.E. Warren AFB. Only Whiteman AFB gets the majority of its water supply from well fields and not from a municipal source (21). The major water use in the vicinity of three bases is for municipal purposes with the other three bases being predominantly rural and agricultural. Most missile LCFs are on their own wells.

### 3.3.3 HEAVY BOMBER STORAGE, CONVERSION, OR ELIMINATION FACILITIES

All facilities are within fairly large river drainage basins, but because of the different physiographic locations and climates, surface water resources are intermittent at Davis-Monthan AFB and prevalent at Tinker and Kelly AFBs. The vicinity of Tinker and Kelly contains perennial streams while Davis-Monthan supports concrete drainage ditches and canals. Large reservoirs also exist in the vicinity of Tinker. Although large quantities of good quality ground water exist at all facilities, extensive overdrafting has caused major declines in the ground water level at Davis-Monthan AFB. This has resulted in minor ground subsidence in the region surrounding this facility. The major water users at all locations are municipal and industrial.

### 3.3.4 MISSILE STORAGE, CONVERSION, OR ELIMINATION FACILITIES

Distinct differences exist among the elimination/conversion sites. Surface water supply ranges from perennial waterways to ephemeral drainages. Local aquifers have sufficient water supply in some locations while experiencing an overdraft in other locations. Ground water quality ranges from good to highly mineralized. Most of the mineralized ground water is potable and meets primary and secondary drinking water standards. The major water users vary with the locations ranging from municipal to agricultural.

## 3.4 GEOLOGY/SOILS

Resource Definition. This resource includes soils, geology, energy, and mineral resources. The soils resource refers to unconsolidated earth materials and their use and susceptibility to erosion; geology refers to consolidated earth materials and hazards such as ground subsidence and seismic activity; energy resources refer to materials including oil, gas, and coal; mineral resources refers to commercially valuable geologic material such as metal ores, limestone, etc.

Statutory and Regulatory Setting. Some of the federal and state laws, regulations, and policies addressing potential environmental impacts on soils and geologic resources include the protection of mineral rights, building codes for construction in areas of known seismic activity, and the Federal Soil Conservation Law (16 USC 590a). This law provides for the control and prevention of soil erosion by preventive measures, including, but not limited to, construction and engineering operations, methods of cultivation, growing of vegetation, and changes in land use.

### 3.4.1 ICBM DEPLOYMENT BASES

The soils vary among the sites, with Ellsworth AFB having a higher shrink-swell potential and lower strength than the others. The soil texture includes loam, shale, and sand with minimal amounts of saline soils and range from poorly- to well-drained. The soils at Minot, Grand Forks, and Ellsworth AFBs have been classified by the U.S. Soil Conservation Service as prime farmland. Wind erosion of unvegetated/disturbed ground at Malmstrom, Minot, F.E. Warren, and Grand Forks AFB deployment areas is a major concern of State Soil Conservation Service agencies.

Five of the six locations occur in seismic zone 1. This zone exhibits the potential for distant earthquakes to cause minor damage to structures. Only the Ellsworth AFB deployment area has active faults with the potential for reduced soil strength and terrain failure during earthquakes. Energy resources exist at all sites while mineral resources are found only within the deployment areas surrounding Whiteman, F.E. Warren, and Ellsworth AFBs.

### 3.4.2 HEAVY BOMBER STORAGE, CONVERSION, OR ELIMINATION FACILITIES

The soils at the three locations have distinct differences. Davis-Monthan AFB is predominantly well-drained, gravelly and/or sandy loam, while Tinker AFB has poorly-drained, fine, clayey loam and Kelly AFB has poorly drained, fine-grain soils. The geology is also quite different, with no major faults or fracture zones mapped near Tinker AFB. Faults are mapped in the vicinity of Davis-Monthan AFB with an earthquake potential of a magnitude of 7.5 and ground subsidence, and fracturing occurs due to groundwater withdrawal. Kelly AFB also occupies a position within a significant fault zone. Energy and mineral resources are located in the vicinity of all facilities.

### 3.4.3 MISSILE STORAGE, CONVERSION, OR ELIMINATION FACILITIES

Soils at the majority of locations are characterized by unconsolidated silts, sands, and gravels, with wind and sheet erosion being quite common. Soils in the vicinity of Hill AFB tend to have moderate concentrations of salt. Faults and seismic activity are prevalent at all locations, but the magnitude of the activity ranges from minor to moderately extensive. Energy and mineral resources vary at each site from none to on-going oil and gas exploration.

## 3.5 CULTURAL RESOURCES

Resource Definition. There are four elements that describe cultural resources. Prehistoric resources, the first element, are physical properties resulting from human activities that pre-date written records and are generally identified as isolated artifacts or sites. Historic resources, the second element, include physical properties and architectural structures originating since the introduction of written records. These resources have important research potential because of their association with historical people or events, or have distinctive architectural styles. Paleontological resources consist of the physical remains or impressions of life-forms from a former geological age and provide scientific information on the history of plants and animals. Native American resources, the fourth element, are sites, areas, and materials that may be historic or prehistoric and are important for religious or traditional reasons. This also includes sacred spaces.

Statutory and Regulatory Setting. Federal actions that may potentially threaten cultural resources must comply with numerous regulatory requirements. The National Historic Preservation Act (NHPA), as amended, 16 USC 470 (36 CFR Parts 60, 61, 63, 65, 67, 68, and 100, and Executive Order 11593), is the fundamental law for the protection, rehabilitation, restoration, and reconstruction of cultural resources. The Protection of Historic and Cultural Properties (36 CFR 800) implements section 106 of the NHPA describing federal agency responsibilities for protecting properties eligible for or included in the National Register of Historic Places (NRHP). The Antiquities Act of 1906 (16 USC 431) provides for the protection of historic or prehistoric remains on federal lands, and the American Indian Religious Freedom Act of 1978 (AIRFA) (42 USC 1996) protects and preserves the inherent right of American Indians to freely believe, express, and practice their traditional religions. New construction in areas not previously surveyed for historical or Native American artifacts or use would need to consider the AIRFA. The Archaeological Resource Protection Act (ARPA) of 1979, 16 USC 470 (36 CFR 296), provides for the protection and preservation of archeological resources on both Federal and Indian lands. The Archaeological and Historic Preservation Act (AHPA) of 1974 (88 State. 174) provides funding for the protection of historical and archaeological remains and sites affected by Federal activities. Additionally, each service implements DOD Directive 4710.1, Archaeological and Historic Resource Management and Executive Order 11593, Protection and Enhancement of the Cultural Environment.

### 3.5.1 ICBM DEPLOYMENT BASES

Previous research in the vicinity of all deployment sites has recorded findings of prehistoric cultural resources ranging from only two sites up to as many as 900 sites. With the highest site densities along river and stream floodplains and bluffs, the sites consist of such things as lithic scatters, tepee rings, and cairns. The number of historic and architectural resources such as homesteads, roads, military posts, and buildings is just as varied, ranging from a low of 75 up to 2,700 sites. The Whiteman AFB vicinity has

26 sites listed in the NRHP, and F.E. Warren AFB is designated a Historic District/National Landmark. There is evidence of paleontological localities at five of the six deployment sites, the F.E. Warren deployment area being the one site with no evidence of paleontological localities.

Indian groups have occupied or passed through all the deployment areas, but Native American burials and sacred areas are known to occur in only half of these areas, with the potential to occur in the vicinity of the others. Native American Indian reservations border the periphery of Ellsworth, Grand Forks, and Minot AFBs.

### 3.5.2 BOMBER STORAGE, CONVERSION, OR ELIMINATION FACILITIES

The regions around Davis-Monthan and Tinker AFBs have an extensive cultural past due to the influence of Native American habitation. Sacred and traditional areas occur in the vicinity of Davis-Monthan AFB, with the potential to occur at Tinker AFB. The region of Davis-Monthan has undergone intense investigations resulting in a number of recorded prehistoric and historic resources, including complex village sites, roads, mining camps, and military posts. One of the most important paleontological localities for an extinct fauna occurs in the river valley adjacent to Davis-Monthan AFB. No historic, cultural, or archaeological sites occur at Kelly AFB.

### 3.5.3 MISSILE STORAGE, CONVERSION, OR ELIMINATION FACILITIES

The availability of information on cultural resources for the conversion or elimination facilities varied from complete, professional surveys of the installations, to the recording of sites by amateur archaeologists. Prehistoric and historic resources ranging from bones and shells to cemeteries, railroads, and mining camps, were recorded in the vicinity of all locations. It is anticipated that Native American resources occur in the vicinity of those sites that are in proximity to existing Indian reservations. Only a few sites listed on the NRHP or designated National Landmarks have been identified at the potential locations, but others may exist in the immediate vicinities.

## 3.6 VISUAL RESOURCES

Resource Definition. Visual resources consist of the natural and man-made landscape features that appear indigenous to the area, that give a particular environment its aesthetic qualities. These landscape characteristics form the overall impression that a viewer receives of an area. The importance of change in visual resources, termed visual sensitivity, is influenced by social considerations.

Statutory and Regulatory Setting. Activities affecting visual resources are regulated by federal statutes that apply to public lands and federally protected areas. State and local regulations and plans pertain to scenic highway designations and the protection of sensitive environments such as coastal, recreational, and open spaces. One statute, the Federal Land Policy and Management Act of 1976, provides for the management of public lands to protect the quality of ecological, environmental, and scenic values. A federal policy, the Forest Service Visual Management System, requires that development on Forest Service lands conform with land management plans which describe visual quality objectives.

### 3.6.1 ICBM DEPLOYMENT BASES

The local landscape of the bases is dominated by flat to gently rolling agricultural and grazing lands with designated scenic highways passing through all of the missile deployment areas. Non-commercial forest land partially surrounds Whiteman AFB. Areas of special visual quality along the periphery of the deployment areas include a national forest, park, grassland, and wildlife refuge, along with a large reservoir and mountainous terrain. Three LFs near Malmstrom AFB are located within a national forest.

### 3.6.2 HEAVY BOMBER STORAGE, CONVERSION, OR ELIMINATION FACILITIES

The proposed action would not result in any new or different operational or maintenance activities at the facilities, but could result in an increased level of activity. In addition to base support facilities, the local landscape and visual characteristics consist of aircraft open storage areas and unoccupied open fields. Approximately 2,500 acres of open space at Davis-Monthan AFB is used for the storage of bombers.

### 3.6.3 MISSILE STORAGE, CONVERSION, OR ELIMINATION FACILITIES

The visual characteristics of the storage, conversion, or elimination sites are quite diverse and include mountain ranges, mesas, grasslands, floodplains, agricultural lands, lakes, and oceans. Designated scenic highways pass by some of the locations. Areas of special visual quality in the vicinity of some sites include national forests, parks, refuges, and seashores.

## 3.7 TRANSPORTATION

Definition of Resource. The national transportation system consists of extensive networks of road, rail, and air transport. The transportation system most likely to be affected by the proposed action is the road network. Commercial airports and public transportation systems are not expected to be affected. The types and levels of service of the road network in the proposed action area ranges from interstate, primary US, and state highways, to single-lane farm roads. The level of service is a measure of the quality of service provided by a road segment or intersection and the likely level of acceptability of given traffic conditions to motorists.

Statutory and Regulatory Setting. The Level of Service is a qualitative measure developed by the US Department of Transportation Research Board. This measurement incorporates the collective factors of speed, travel time, traffic interruptions, safety, driving convenience, and operating costs provided by a road facility under a particular volume condition.

### 3.7.1 ICBM DEPLOYMENT BASES

The road network in the vicinity of all six bases ranges from interstates to one-lane, gravel-surfaced farm roads. The bases are located in rural areas; therefore, most of the road network consists of two-lane, asphalt state highways, and gravel roads maintained by the local county. Hundreds of miles of roads connect the LFs and LCFs with the deployment bases. Missile TE vehicles use the roads between a base and the LFs on a regular basis. A typical ICBM base removes and replaces approximately ten percent of its missiles each year for maintenance. The traffic volume for most roads between a base and the LFs could be considered quite low, with varying physical operational conditions.

### 3.7.2 MISSILE STORAGE, CONVERSION, OR ELIMINATION FACILITIES

The missile storage, conversion, or elimination facilities are located throughout a wide range of geographic areas. Therefore, the road networks could consist of multi-lane freeways or gravel-surfaced county roads. The network could experience traffic volumes over capacity at peak periods or could be only travelled by personnel associated with the facility. There could also be varying physical operating conditions of the networks due to the traffic volumes and the different geographic locations of the facilities.

## 3.8 BIOLOGICAL RESOURCES

Resource Definition. Biological resources are defined as the terrestrial and aquatic ecosystems with the native and naturalized plants and animals which occur throughout them. This includes plant populations and communities, wildlife populations and their relationship to habitat, threatened or endangered species, and aquatic, wetland, and riparian ecosystems. Plant and animal species that are candidates for, or are listed as, threatened or endangered by the US Fish and Wildlife Service (USFWS), and species having equivalent status at the state level, are given special consideration by law for their preservation.

Statutory and Regulatory Setting. Federal statutes impose specific regulatory requirements for the protection, conservation, and preservation of the biological resources. Applicable regulations include the following.

The Endangered Species Act, 16 USC 1531 et seq., as amended (50 CFR Parts 13, 17, 222, 226, 227, 402, 424, and 450-453), provides protection for listed and candidate species, and for their critical habitat. It requires special consultation and assessment of impacts for projects carried out or administered by federal agencies. Many states have laws which also seek to protect designated species.

Section 404 of the Clean Water Act (33 USC 1251 et seq.) regulates the development in lakes, streams, and wetlands.

The Coastal Zone Management Act (16 USC 1331 et seq.) requires that federal actions be consistent with Federally-approved state and local plans designed to protect and enhance the coastal zone resources.

Executive Order 11190, Protection of Wetlands (16 USC 1221-1226), directs federal agencies to avoid the long- and short-term impacts associated with the destruction or modification of wetlands.

The Fish and Wildlife Coordination Act (16 USC 661-667) provides for the coordination between federal, state, public, and private agencies on management plans for fish and wildlife.

### 3.8.1 HEAVY BOMBER DEPLOYMENT BASES

The proposed action would leave the biological resources unchanged and unaffected at the heavy bomber deployment bases; therefore, this resource category will not be addressed in this chapter. However, the elimination of aircraft would ultimately reduce the amount of bomber activity in the numerous low-level training routes and weapons ranges located in many parts of the US. Many of the routes are located over sparsely populated, undeveloped regions of the US and across migratory bird flyways. Abundant

and diverse wildlife occurs throughout many of these areas. Of special significance are big game animals, waterfowl, and threatened and endangered species including the bald eagle, peregrine falcon, and whooping crane.

### 3.8.2 ICBM DEPLOYMENT BASES

Diverse biological habitats exist within the deployment areas of the ICBM bases characterized by grassland, forest, riparian woodlands, rivers and streams, wetlands, and aquatic areas which all support wildlife. The majority of the sites lie in former prairie grassland regions which are now agricultural lands. Malmstrom AFB contains mostly grassland, Minot and Grand Forks AFBs support the majority of their wildlife through prairie pothole wetlands, while the remaining bases are in rolling hills and mountainous regions with various densities of forestland.

A diversity of wildlife occurs throughout the deployment sites. Three of the areas contain a variety of large and small game mammals, furbearers, as well as abundant aquatic life and avian species including waterfowl, upland game, and shorebirds. The other three areas support fewer larger mammalian species, yet small game and non-game mammals, avian, and aquatic life occur in varying degrees of abundance. Domestic livestock can also be found in the vicinity of most of the sites.

Threatened and endangered species are present in each area. Several federally listed, candidate, or state-recognized species occur on or near the bases and in the surrounding deployment sites. The protected species include mammals, birds of prey, shorebirds, waterfowl, aquatic life, and numerous species of plants.

### 3.8.3 HEAVY BOMBER STORAGE, CONVERSION, OR ELIMINATION FACILITIES

The potential facilities for heavy bomber storage, conversion, or elimination, Tinker AFB located in Oklahoma, Davis-Monthan AFB located in Arizona, and Kelly AFB located in Texas have distinct terrestrial and aquatic ecosystems. Davis-Monthan AFB exhibits a desert scrub dominated by cacti, creosote bush, and small trees, whereas Tinker AFB is characterized by tall grass prairie with forested regions and agricultural lands. Very few areas of natural terrestrial habitat exist at Kelly AFB. Vegetation density and variety are limited to the desert "washes" at Davis-Monthan AFB, compared to perennial streams and lakes at Tinker AFB. Despite the harsh desert environment at Davis-Monthan, many birds, mammals, and herpetofauna exist, including roadrunners, cottontails, and lizards. The contrasting vegetation types in the vicinity of Tinker AFB support upland game birds, deer, small furbearers, and game fish. No wetland habitats exist at Kelly, and wildlife species diversity and population numbers in the area are limited because of the lack of natural habitat. Threatened or endangered species may occur in the vicinity of Tinker and Davis-Monthan AFBs, including a desert plant just recently listed at Davis-Monthan AFB.

### 3.8.4 MISSILE STORAGE, CONVERSION, OR ELIMINATION FACILITIES

The biological resources of Cape Canaveral and Vandenberg exhibit characteristics of coastal environments, including coastal dune and scrub vegetation, with the addition of grasslands, chaparral, and woodland communities at Vandenberg.

A diversity of biological resources exists at the other elimination facilities. The ecosystems range from arid, desert communities to rolling hills and lakes. With desert scrub and grasslands to woodland vegetation, a variety of wildlife species exists ranging from the collared lizard to mule deer to a viable fishery. On-going activities at some of the elimination sites currently affect the vegetation and wildlife communities.

Threatened or endangered species occur in the vicinity of all potential storage, conversion, and elimination facilities. The aquatic and terrestrial habitats, considered unique and sensitive at some sites, support a vast assemblage of protected species, including birds, reptiles, mammals, and plants.

## 3.9 HUMAN HEALTH AND SAFETY

Resource Description. This resource category addresses those issues that pose a threat or danger to the safety, health, and well-being of the general public. This includes the handling, storage, and disposal of hazardous wastes, the handling and storage of nuclear materials, explosive safety, aircraft accident potential, and transportation accident potential. Human health and safety issues related to air quality and noise are also included in this description.

Statutory and Regulatory Setting. The health and safety of military and civilian personnel, and ultimately the general public, are safeguarded by numerous DOD regulations designed to comply with the Occupational Safety and Health Administration (OSHA) and EPA standards. EPA is currently working on health advisories for energetic compounds. Federal statutes that impose specific requirements pertaining to health and safety issues include the following.

The Resource Conservation and Recovery Act of 1976, as amended by the Hazardous and Solid Waste Amendment of 1984 (42 USC 6901), is the basic law for regulating hazardous waste management practices and provides for the safe treatment and disposal of wastes. It also regulates the maintenance and removal of underground storage tanks.

The Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) as amended by the Superfund Amendments and Reauthorization Act (SARA) [42 USC 9601 et seq.], establishes the procedures for responding to hazardous substance releases to the environment, creates the National Priorities List which sets forth those sites considered to have the highest priority for cleanup, and establishes requirements relating to the level of contamination cleanup and the role of the state in the cleanup process. The Defense Environmental Restoration Program, a DOD program under CERCLA, provides for the identification, investigation, and cleanup of contamination from hazardous substances. The DOD has instituted the Installation Restoration Program (IRP) for assessing and controlling migration of environmental contamination that may have resulted from past operational and disposal practices on DOD facilities.

DOD Directive 5030.15 establishes the policy for continual evaluation of nuclear weapon systems in pursuit of the highest possible standards of nuclear safety. The services tailor this directive to their needs and establish safety groups to conduct safety studies and operational reviews of nuclear weapon systems for which the services are responsible. Because nuclear materials are associated with strategic arms, processing of nuclear material drawn from weapons taken out of deployment will be in accordance with and, where required, analyzed in site-specific environmental documents.

DOD Directive 5154.4-S and OSHA Standard 1910.109 establish safety criteria for explosives. Air Force Regulation 127-100 and Naval Sea Systems Command Ordnance

Publications 5 and 2965 prescribe safety zones or quantity distance criteria for facilities which contain explosives.

The OSHA Asbestos Standard (29 CFR 1926.58) lists the federal requirements for handling and removing asbestos from equipment and building structures during construction activities.

The National Ambient Air Quality Standards (40 CFR 50) are intended to give the public an adequate margin of safety for protection from adverse health and welfare effects due to exposure to various pollutants.

The Noise Control Act of 1972 directs federal agencies to carry out their programs to minimize noise impacts on public health and welfare, and Army Regulation 200-1 presents 65 $L_{dn}$ as a standard which is enforceable for all army installations.

The Hazardous Materials Transportation Act of 1974 (PL 93-633 and 40 CFR Part 146, 171-178, 297, and 379) governs the truck and rail transport of hazardous materials and seeks to "protect the nation adequately against the risks to life and property inherent in the transportation of hazardous materials in commerce." Under this act, the DOT formulates regulations to ensure safety in transit. These regulations cover packaging, marketing, loading, and handling of materials in transit and the precautions necessary to determine whether material to be shipped is in proper condition for transport.

The Toxic Substances Control Act (TSCA) governs the proper removal and disposal of PCB-contaminated equipment and substances (soils, cement, clothing, etc.).

DOD requires that a comprehensive systems safety hazards analysis addressing all potentially hazardous elements of the missile system be accomplished prior to deployment. These directives provide for the (1) identification of hazard by category (e.g., explosive, chemical, nuclear); (2) analysis of the potential effect of the subject hazardous elements on personnel and resources, given various mishap scenarios; (3) safety criteria pertaining to the use and handling of hazardous materials; and (4) adequate weapon system design features and procedural safeguards to meet all DOD and OSHA safety standards.

### 3.9.1 HEAVY BOMBER DEPLOYMENT BASES

All bomber bases conduct a flying safety program to ensure the airworthiness of each aircraft, proficiency of the aircrews, and safe airborne operations. Land use is restricted in zones around and at the ends of the runway because of the high accident potential in these areas. The AICUZ program provides guidelines to the local communities for compatible land use surrounding each base (see Section 3.2.1).

Hazardous waste management plans are in place at each base. Handling, storage, and disposal are done in compliance with applicable regulatory requirements. The bases are at different phases in the IRP for the control of hazardous contamination. An air emissions inventory is completed for the bases to monitor pollutant levels from operation, maintenance, and flying activities.

### 3.9.2 ICBM DEPLOYMENT BASES

The Defense Department has formal safety programs addressing missile logistics. These programs provide detailed safety requirements and training and a mandatory reporting system for identifying safety-related problems. Each branch of service affected conducts inspections of missile facilities to ensure compliance with the rigid safety criteria currently established.

Safety provisions are incorporated into all aspects of missile maintenance and transport. The US has a long record of safe handling and maintenance of missiles.

A quantity/distance arc for safety surrounds the deployment facilities. Elimination of some silo launchers could involve asbestos removal and disposal. Asbestos removal is ongoing at many DOD facilities and follows applicable OSHA and DOD regulations. Any removed asbestos will be disposed of in accordance with applicable regulations.

### 3.9.3 HEAVY BOMBER STORAGE, CONVERSION, OR ELIMINATION FACILITIES

Safety provisions and procedures similar to those at the bomber deployment bases are in place at Davis-Monthan, Kelly, and Tinker AFBs. These include the establishment of safety zones around the runways and programs for the safe handling, disposal, and clean up of hazardous wastes. Both facilities, having a highly industrialized mission, operate under OSHA regulations. These regulations govern worker exposure to both noise and VOCs from painting (see Section 3.1.4).

### 3.9.4 MISSILE STORAGE, CONVERSION, OR ELIMINATION FACILITIES

DOD and contractor organizations are experienced with the handling, storage and elimination, and conversion of rocket motors. Established safety guidelines and procedures are in place to reduce risks to workers and to public health and safety. These procedures include maintaining a specific distance from the elimination activity to ensure the workers safe exposure limits from noise and falling debris and operating with a minimum designated wind speed to prevent public exposure from the plume migration.

## 3.10 SOCIOECONOMICS

Resources Definition: Socioeconomic resources consist of several primary elements including population, employment, and income. Economic modeling studies show that there is a linear relationship among these primary elements and secondary socioeconomic variables including the demand for educational services, transportation needs, demand for fire/police protection, property values, and the market for housing in a given community.

The LEIS socioeconomic analysis focuses on the primary elements of population, employment and income factors, based on the assumption that a description and impact analysis of the primary factors will provide a sufficient baseline at the programmatic or legislative EIS level to identify communities or regions that may experience significant socioeconomic impacts from Treaty-related actions.

An analysis of secondary elements will be evaluated in subsequent environmental documents specifically addressing the magnitude of impacts on local schools, public services, and public finances. The appropriate mitigating measures for these impacts will also be presented in subsequent environmental studies.

The LEIS examines the base or facility impacts at two geographic levels: (1) the county in which the base or facility is located, referred to as the primary county; and (2) the region, defined as all counties located within a fifty-mile radius of the base or facility. An analysis at two geographic levels allows for an overview evaluation of potential impacts at both local and regional levels. The regional perspective is particularly important because of potential long-distance commuting patterns for base and facility employees. The economic interrelationships between the local area and the regional economic base also become more evident when analyzed on two geographic levels.

For analysis purposes, the bases and facilities were grouped into three categories: heavy bomber bases, ICBM bases, and conversion or elimination facilities. Conversion or elimination facilities were divided into military installations capable of handling heavy bombers and those installations with the capacity for missile conversion or elimination. Strategic arms deployment bases and conversion or elimination facilities are located in 20 states and near approximately 30 communities. Refer to Figure 2-1 for a map that shows the geographic locations of the bases and facilities discussed in this section.

The data used in the socioeconomic analysis were derived from the Bureau of the Census and the Bureau of Economic Analysis. Forecasted population and employment, diversification indices, and rational threshold values were computed by the Economic Impact Forecast System (EIFS) of the Environmental Technical Information System (ETIS), operated by the US Army Corps of Engineers Construction Engineering Research Laboratory (CERL).

Statutory and Regulatory Setting. Federal, state, and local policy is important in relation to various economic development programs and the qualifications of individual communities to participate in these programs for mitigation purposes. In addition, zoning regulations, land use plans, and farmland and open space preservation policies are regulatory measures that could potentially influence certain aspects of the Treaty program of actions.

National Economy and the Defense Budget. The budget of the US government indicated a national defense expenditure of $290.4 billion in 1988, representing 6.1 percent of the $4,780 billion gross national product (GNP). This expenditure generated a total defense-related employment of 6.5 million jobs, representing 5.7 percent of the total national employment of 115 million jobs.

Defense-related jobs are distributed among three basic categories, including 2.1 million active duty military, 1.0 million DOD civilian employees, and 3.4 million employees with private sector defense contractors.

The defense budget grew fairly rapidly from 1981 to 1986, and stabilized between 1986 to 1990. It now appears that the defense budget may decrease in real terms over the next several years. This decline in defense expenditure outlays may result in a reassessment of national security needs, creating changes in military missions, base realignments, and weapon systems planning. The current composition of these changes, and specific impacts to various sectors of the defense industry, are unknown at this time.

Implementation of the Treaty could impact local and regional economies tied to the weapons systems involved, which ultimately may have some impact at the national level. This brief review of national trends provides a baseline for the assessment of these potential impacts presented in Section 4.10.

### 3.10.1 HEAVY BOMBER DEPLOYMENT BASES

Heavy bomber candidates scheduled for reduction under the proposed action are the B-52 and B-1B, which are located at fourteen bases around the US. Ten of these bases are west of the Mississippi River, two are in the northeastern US, and the remaining two are in the Great Lakes area. Ellsworth, Grand Forks, and Minot AFBs also house ICBM missiles (see Section 3.10.2). The primary county and the region defined by a fifty-mile radius are the same for Loring AFB in Maine.

#### 3.10.1.1 Demographic Characteristics

The fourteen bomber bases are located in primary counties ranging widely in population size. As Table 3-1 shows, only Carswell AFB is in a county with greater than 1 million population, while eight bases are in primary counties with populations less than 100,000.

| Table 3-1<br>Installations--Population of Primary Counties and 50-Mile Radius Regions | | | | | | |
|---|---|---|---|---|---|---|
| | PRIMARY COUNTY | | | REGION (50-MILE RADIUS) | | |
| | Projected 1990 Popl | Compound Growth Rate | | Projected 1990 Popl | Compound Growth Rate | |
| | | 1980-90 | 1990-95 | | 1980-90 | 1990-95 |
| BOMBER BASES | | | | | | |
| B-52 | | | | | | |
| Barksdale, LA | 99,375 | 2.1% | 1.7% | 601,541 | 1.3% | 1.1% |
| Carswell, TX | 1,141,793 | 2.9% | 2.0% | 3,859,369 | 2.7% | 2.0% |
| Castle, CA | 173,198 | 2.6% | 1.9% | 665,853 | 2.7% | 2.2% |
| Eaker, AR | 57,360 | -0.4% | -1.5% | 429,865 | 0.2% | 0.3% |
| Fairchild, WA | 379,969 | 1.1% | 1.2% | 466,989 | 1.3% | 1.4% |
| Griffiss, NY | 239,528 | -0.6% | -0.7% | 1,040,185 | -0.1% | -0.1% |
| Loring, ME* | 86,358 | -0.6% | -0.6% | 86,358 | -0.6% | -0.6% |
| Minot, ND | 61,677 | 0.5% | 0.2% | 88,684 | 0.2% | -0.1% |
| K I Sawyer, MI | 74,972 | 0.1% | 0.5% | 150,843 | 0.2% | 0.4% |
| Wurtsmith, MI | 31,709 | 1.1% | 0.9% | 156,175 | 0.8% | 0.9% |
| B-1B | | | | | | |
| Dyess, TX | 129,452 | 1.6% | 1.2% | 216,298 | 1.2% | 1.0% |
| Ellsworth, SD | 81,934 | 1.5% | 1.2% | 142,134 | 1.4% | 1.2% |
| Grand Forks, ND | 71,496 | 0.8% | 0.6% | 148,991 | 0.1% | 0.1% |
| McConnell, KS | 399,464 | 0.9% | 0.7% | 636,426 | 0.7% | 0.7% |
| U.S. | 250,301,000 | 1.0% | | | | |

*Primary county and 50-mile radius region are the same.

Over the past decade the primary counties have experienced population growth rates ranging from -0.6 to 2.9 percent as compared to the US annual growth rate of 1.0 percent. Only Carswell and Castle AFBs are in counties with growth rates greater than 2.5 percent, while Eaker, Loring, and Griffiss AFBs are in counties with declining populations. Forecast growth rates for 1990-1995 in the primary counties show that three primary counties are expected to decline in population, while the remaining counties will experience stable to moderate growth.

At the regional level population trends and projections followed patterns similar to that of the primary county. One notable exception is Eaker AFB, where the primary county shows historic and forecasted population declines as compared to the region, which is experiencing population growth.

### 3.10.1.2 Employment and Income Characteristics

The 1989 primary county employment for the communities around the bomber bases ranged from fewer than 13,000 at Wurtsmith AFB to more than 618,000 at Carswell AFB (Table 3-2). Growth rates from 1984-1989 varied widely at the county level, from basically no growth at Eaker AFB to growth rates in excess of 2.5 percent annually at Castle and Carswell AFBs. Employment in the multi-county regions ranged from fewer

than 48,000 at Minot AFB to almost 2.4 million at Carswell AFB. Barksdale AFB's multi-county region was the only area that experienced a decline in the number of people employed during the 1984-1989 period.

**Table 3-2**
**Installations--Employment of Primary Counties and 50-Mile Radius Regions**

| | PRIMARY COUNTY | | | REGION (50-MILE RADIUS) | | |
|---|---|---|---|---|---|---|
| | Projected 1989 Empl. | Compound Growth Rate | | Projected 1989 Empl. | Compound Growth Rate | |
| | | 1984-89 | 1989-95 | | 1984-89 | 1989-95 |
| BOMBER BASES | | | | | | |
| B-52 | | | | | | |
| Barksdale, LA | 39,287 | 1.8% | 2.0% | 273,226 | -0.9% | 1.5% |
| Carswell, TX | 618,870 | 2.6% | 2.6% | 2,376,119 | 2.6% | 2.7% |
| Castle, CA | 74,051 | 2.7% | 1.9% | 281,562 | 3.2% | 2.2% |
| Eaker, AR | 27,992 | 0.2% | 0.1% | 177,150 | 0.7% | 0.4% |
| Fairchild, WA | 190,314 | 2.2% | 1.9% | 225,366 | 2.2% | 2.0% |
| Griffiss, NY | 120,962 | 0.4% | 0.5% | 527,159 | 0.9% | 1.0% |
| Loring, ME* | 42,196 | 0.5% | 0.4% | 42,196 | 0.5% | 0.4% |
| Minot, ND | 34,720 | 1.1% | 1.1% | 47,926 | 0.8% | 0.9% |
| K I Sawyer, MI | 33,775 | 1.7% | 1.1% | 65,337 | 1.8% | 1.0% |
| Wurtsmith, MI | 12,512 | 1.2% | 0.8% | 58,403 | 1.6% | 1.1% |
| B-1B | | | | | | |
| Dyess, TX | 53,015 | 2.0% | 2.1% | 76,368 | 1.8% | 1.8% |
| Ellsworth, SD | 80,947 | 1.9% | 2.2% | 118,942 | 1.3% | 1.7% |
| Grand Forks, ND | 42,063 | 1.9% | 1.6% | 84,782 | 1.4% | 1.1% |
| McConnell, KS | 262,659 | 2.1% | 1.8% | 378,395 | 1.9% | 1.6% |
| U.S. | 131,121,000 | 1.9% | 1.6% | | | |

*Primary county and 50-mile radius region are the same

Military Air Force base employment varies in significance as a percent of total county employment, from less than one percent in the largest metropolitan county where Carswell AFB is located, to almost one-third at Wurtsmith AFB. Base employment is less significant at the regional level, with the highest dependence representing twelve percent for the Minot AFB region. The employment at Ellsworth AFB was also significant at the regional level, representing approximately ten percent of total employment in the multi-county region.

The military employment, as a percentage of total federal employment, in 1987 was calculated for each primary county and region. Military employment included other military personnel in the area along with those at the bomber base. All AFBs, except Carswell AFB, are located in counties where military employment constitutes a majority of federal employment, ranging up to nearly 100 percent at Eaker AFB (Table 3-3). At the regional level, military employment was only one-third of all federal employment in the region surrounding Carswell AFB, but was above seventy percent for seven bases.

| Table 3-3 Base Employment and Total Federal Government Employment | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 1989 | | | COUNTY | | REGION | |
| | Total Base Employees | Base % of County Empl. | Base % of Region Empl. | Federal Empl. Total | Military % of all Federal | Federal Empl. Total | Military % of all Federal |
| BOMBER BASES | | | | | | | |
| B-52 | | | | | | | |
| Barksdale, LA | 7,041 | 17.9 | 2.6 | 9,193 | 76.9 | 14,628 | 63.7 |
| Carswell, TX | 5,722 | 0.9 | 0.2 | 22,567 | 41.6 | 62,199 | 33.6 |
| Castle, CA | 5,236 | 7.1 | 1.9 | 7,402 | 82.8 | 11,117 | 68.8 |
| Eaker, AR | 3,239 | 11.6 | 1.8 | 3,599 | 97.7 | 7,653 | 72.7 |
| Fairchild, WA | 4,474 | 2.4 | 2.0 | 11,266 | 60.4 | 12,297 | 58.7 |
| Griffiss, NY | 6,008 | 5.0 | 1.1 | 9,424 | 52.9 | 16,212 | 44.2 |
| Loring, ME* | 3,988 | 9.5 | 9.5 | 6,025 | 73.2 | 6,025 | 73.2 |
| Minot, ND | 5,966 | 17.2 | 12.4 | 7,889 | 81.5 | 8,427 | 78.6 |
| K I Sawyer, MI | 4,005 | 11.9 | 6.1 | 5,097 | 77.9 | 6,204 | 67.0 |
| Wurtsmith, MI | 3,679 | 29.4 | 6.3 | 4,500 | 80.3 | 5,286 | 74.9 |
| B-1B | | | | | | | |
| Dyess, TX | 7,248 | 13.7 | 9.5 | 9,186 | 79.6 | 10,672 | 71.8 |
| Ellsworth, SD | 4,459 | 5.5 | 3.7 | 7,853 | 81.4 | 8,511 | 79.1 |
| Grand Forks, ND | 5,602 | 13.3 | 6.8 | 7,276 | 79.4 | 8,160 | 76.2 |
| McConnell, KS | 3,541 | 13.0 | 0.9 | 11,706 | 64.0 | 15,348 | 66.6 |
| U.S. | | | | 5,979,000 | 47.4 | | |
| *Primary county and 50-mile radius region are the same | | | | | | | |

Per capita income in the 14 communities is highly divergent, ranging from only two-thirds of the US average at Eaker AFB to more than 100 percent at Carswell and McConnell AFBs (Table 3-4). A similar divergence occurs among the regions, with per capita income slightly higher in the region than the primary county for eight of the 14 communities.

### 3.10.1.3 Economic Diversification and Historic Fluctuation

Employment sector diversification indices were used to determine the extent to which county and regional economies are diversified relative to the US as a whole. A value of 1.0 indicates that a local economy has employment in all economic sectors found in the US. Correspondingly, low index values show that a local economy has employment in only a few employment sectors, and thus is more subject to impact if changes occur within those few sectors. The sector of maximum employment was also identified for each primary county and region. In the US as a whole, the sector of maximum employment is services.

Carswell AFB and Fairchild AFB have the most diverse economies at the primary-county level with diversification indices of above .75 while Wurtsmith AFB and Eaker AFB had the lowest level of diversification with indices of below .45. As would be expected, regional diversification indices were higher than at the primary-county level.

| Table 3-4<br>1987 Per Capita Income by Primary County and Region | | | | |
|---|---|---|---|---|
| | PRIMARY COUNTY | % OF US | 50-MILE REGION | % OF US |
| BOMBER BASES | | | | |
| B-52 | | | | |
| Barksdale, LA | $11,391 | 73.6% | $11,847 | 76.5% |
| Carswell, TX | 16,239 | 104.9% | 17,061 | 110.2% |
| Castle, CA | 12,919 | 83.4% | 13,212 | 85.3% |
| Eaker, AR | 10,018 | 64.7% | 10,382 | 67.0% |
| Fairchild, WA | 13,656 | 88.2% | 13,501 | 87.2% |
| Griffiss, NY | 13,924 | 89.9% | 14,331 | 92.6% |
| Loring, ME* | 11,904 | 76.9% | 11,904 | 76.9% |
| Minot, ND | 12,246 | 79.1% | 12,081 | 78.0% |
| K I Sawyer, MI | 11,772 | 76.0% | 12,038 | 77.7% |
| Wurtsmith, MI | 11,023 | 71.2% | 11,807 | 76.3% |
| B-1B | | | | |
| Ellsworth, SD | 12,975 | 83.8% | 12,173 | 78.6% |
| Dyess, TX | 13,372 | 86.4% | 13,089 | 84.5% |
| Grand Forks, ND | 12,690 | 82.0% | 13,458 | 86.9% |
| McConnell, KS | 16,220 | 104.8% | 15,351 | 99.1% |
| US per capita income | $15,484 | | | |
| *Primary County and 50-mile radius region are the same | | | | |

At the primary-county level government was the predominant employment sector in nine counties, with the service sector as the major source of employment in the remaining five (Table 3-5). At the regional level, the picture shifted slightly with seven regions dominated by service employment and six regions with government as the major source of employment. For the region surrounding Eaker AFB, manufacturing was the major employment sector.

The Rational Threshold Value (RTV) is a measure used by EIFS to indicate historic fluctuation, both positive and negative, in an area's economy. The period used for analysis was 1969-1987. For comparative purposes in this LEIS, economic fluctuation in an area was measured by summing the absolute values of the positive and negative RTVs for employment. Generally, low values would indicate the economy has been relatively stable as compared to areas with high values which indicate that the area has probably experienced higher shock levels of either employment, growth, or decline. Multi-county regions also have lower values than is evident at the single-county level because, as the size of the economic region increases, decreases in one industry can be absorbed by industries in other sectors, which serve as a leveling effect to employment fluctuations.

The RTV for employment in the primary counties indicate that many areas have experienced wide economic swings over the twenty-year period. The primary counties for K.I. Sawyer AFB and Dyess AFB historically have experienced the greatest fluctuations in employment. Minot AFB and Grand Forks AFBs, both located in North

| Table 3-5<br>Employment Diversification Index, Major Employment Sector, and Sum of Absolute Values, Rational Threshold Values for Employment | | | | | | |
|---|---|---|---|---|---|---|
| | PRIMARY COUNTY | | | REGION | | |
| | Weighted Divers. Index | Max. Empl. Sector | RTV Total Absolute Value | Weighted Divers. Index | Max. Empl. Sector | RTV Total Absolute Value |
| BOMBER BASES | | | | | | |
| B-52 | | | | | | |
| Barksdale, LA | 0.5225 | G | 8.594 | 0.7526 | S | 5.912 |
| Carswell, TX | 0.7778 | S | 9.471 | 0.8849 | S | 9.210 |
| Castle, CA | 0.6309 | G | 5.515 | 0.7809 | S | 6.310 |
| Eaker, AR | 0.4496 | G | 9.019 | 0.7150 | M | 6.007 |
| Fairchild, WA | 0.7560 | S | 7.368 | 0.7928 | S | 7.311 |
| Griffiss, NY | 0.6987 | S | 6.898 | 0.7950 | S | 6.639 |
| Loring, ME* | 0.5737 | G | 5.875 | 0.5737 | G | 5.875 |
| Minot, ND | 0.5529 | G | 4.696 | 0.5843 | G | 4.187 |
| K I Sawyer, MI | 0.5310 | G | 10.398 | 0.6269 | G | 7.167 |
| Wurtsmith, MI | 0.4143 | G | 7.948 | 0.6063 | G | 7.275 |
| B-1B | | | | | | |
| Ellsworth, SD | 0.6137 | G | 7.968 | 0.5749 | G | 7.218 |
| Dyess, TX | 0.5871 | S | 10.350 | 0.6889 | S | 8.321 |
| Grand Forks, ND | 0.5334 | G | 5.246 | 0.6020 | G | 4.407 |
| McConnell, KS | 0.7367 | S | 9.934 | 0.7881 | S | 7.933 |
| US | 1.0000 | S | 5.161 | | | |

G - Government S - Service M - Manufacturing
*Primary county and 50-mile radius region are the same

Dakota, represent economies that have been more stable in their employment base.

### 3.10.2 ICBM DEPLOYMENT BASES

The ICBMs are deployed at six bases in five states in the central US. Malmstrom and F.E. Warren AFBs are multiple ICBM-mission bases, deploying a combination of missile types. In addition to missiles, bombers are located at Ellsworth, Grand Forks, and Minot AFBs.

#### 3.10.2.1 Demographic Characteristics

The six ICBM bases are located in small- to medium-sized counties with relatively stable growth rates. The counties containing Ellsworth and F.E. Warren AFBs have higher annual growth rates than the national average, while the county containing Malmstrom

AFB showed a slight decline in population over the decade (Table 3-6). At the regional level, Malmstrom AFB has experienced a population decline. Projected growth rates are similar, with declines forecast for the county and region containing Malmstrom AFB and for the region surrounding Minot AFB. In comparison, for the US as a whole a 0.9 percent annual growth rate is forecast for 1990-1995.

**Table 3-6**
**Installations--Population of Primary Counties and 50-Mile Radius Regions**

| | PRIMARY COUNTY | | | REGION (50-MILE RADIUS) | | |
|---|---|---|---|---|---|---|
| | Projected 1990 Popl. | Compound Growth Rate | | Projected 1990 Popl. | Compound Growth Rate | |
| | | 1980-90 | 1990-95 | | 1980-90 | 1990-95 |
| MISSILE BASES | | | | | | |
| MM II | | | | | | |
| Ellsworth, SD | 81,934 | 1.5% | 1.2% | 142,134 | 1.4% | 1.2% |
| Malmstrom, MT | 79,237 | -0.2% | -0.4% | 91,638 | -0.2% | -0.3% |
| Whiteman, MO | 39,706 | 0.2% | 0.6% | 302,841 | 0.7% | 0.7% |
| MM III | | | | | | |
| Grand Forks, ND | 71,496 | 38.0% | 0.6% | 148,991 | 0.1% | 0.1% |
| Malmstrom, MT | 79,237 | -0.2% | -0.4% | 91,638 | -0.2% | -0.3% |
| Minot, ND | 61,677 | 0.5% | 0.2% | 88,684 | 0.2% | -0.1% |
| F E Warren, WY | 80,036 | 1.5% | 1.3% | 309,944 | 2.3% | 2.0% |
| Peacekeeper | | | | | | |
| F E Warren, WY | 80,036 | 1.5% | 1.3% | 309,944 | 2.3% | 2.0% |
| U.S | 250,301,000 | 1.0% | 0.9% | | | |

### 3.10.2.2 Employment and Income Characteristics

The 1989 employment in the six communities around the ICBM bases ranged from fewer than 21,000 at Whiteman AFB to more than 53,000 at Ellsworth AFB (Table 3-7). Employment growth in the primary counties and the regions varied, with primary county compound growth rates, for 1984 to projected 1989 employment, ranging from less than 1.0 percent at Malmstrom AFB to 2.0 percent or more for F.E. Warren and Ellsworth AFBs. By comparison, the US experienced a compound growth rate in employment of 1.9 percent from 1984-1989.

In all primary counties, the ICBM bases are a factor in the economy, with three bases exceeding thirteen percent of total county employment. As expected, base employment is less significant at the regional level, with Whiteman and F.E. Warren AFBs representing less than three percent of total regional employment, and only Minot AFB representing over twelve percent of employment for the region.

Military employment, as a percentage of total federal employment in 1987, was also calculated for each primary county and region. This included other military personnel in the area along with those at the ICBM base. In all cases, military employment constituted

| Table 3-7 Installations--Employment of Primary Counties and 50-Mile Radius Regions | | | | | | |
|---|---|---|---|---|---|---|
| | PRIMARY COUNTY | | | REGION (50-MILE RADIUS) | | |
| | Projected 1989 Empl. | Compound Growth Rate | | Projected 1989 Empl. | Compound Growth Rate | |
| | | 1984-89 | 1989-95 | | 1984-89 | 1989-95 |
| MISSILE BASES | | | | | | |
| MM II | | | | | | |
| Ellsworth, SD | 53,015 | 2.0% | 2.1% | 76,368 | 1.8% | 1.8% |
| Malmstrom, MT | 43,478 | 0.9% | 0.6% | 49,631 | 0.8% | 0.6% |
| Whiteman, MO | 20,572 | 1.4% | 1.5% | 129,662 | 1.1% | 1.1% |
| MM III | | | | | | |
| Grand Forks, ND | 42,063 | 1.9% | 1.6% | 81,782 | 1.4% | 1.1% |
| Malmstrom, MT | 43,478 | 0.9% | 0.6% | 49,631 | 0.8% | 0.6% |
| Minot, ND | 34,720 | 1.1% | 1.1% | 47,926 | 0.8% | 0.9% |
| F E Warren, WY | 47,293 | 2.5% | 1.9% | 166,504 | 3.1% | 2.7% |
| Peacekeeper | | | | | | |
| F E Warren, WY | 47,293 | 2.5% | 1.9% | 166,504 | 3.1% | 2.7% |
| U.S | 131,121,000 | 1.9% | 1.6% | | | |

a majority of federal employment. At the regional level, military employment was slightly over half of all federal employment at F.E. Warren AFB, while in the remaining five communities, military represented approximately three-fourths of federal employment (Table 3-8).

| Table 3-8 Base Employment and Total Federal Government Employment | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | COUNTY | | REGION | |
| | Base Employment | Base % of Empl. County | Base % of Empl. Region | Federal Empl. Total | Military % of all Federal | Federal Empl. Total | Military % of all Federal |
| MISSILE BASES | | | | | | | |
| MM II | | | | | | | |
| Ellsworth, SD | 4,459 | 8.7 | 5.8 | 9,186 | 79.6% | 10,672 | 71.8% |
| Malmstrom, MT | 4,802 | 11.0 | 9.7 | 6,111 | 71.5% | 6,306 | 70.5% |
| Whiteman, MO | 3,649 | 17.7 | 2.8 | 4,519 | 78.4% | 7,551 | 73.4% |
| MM III | | | | | | | |
| Grand Forks, ND | 5,602 | 13.3 | 6.8 | 7,276 | 79.4% | 8,160 | 76.2% |
| Malmstrom, MT | 4,802 | 11.0 | 9.7 | 6,111 | 71.5% | 6,306 | 70.5% |
| Minot, ND | 5,966 | 17.2 | 12.4 | 7,889 | 81.5% | 8,427 | 78.6% |
| F E Warren, WY | 4,176 | 8.8 | 2.5 | 7,225 | 62.2% | 10,321 | 52.9% |
| Peacekeeper | | | | | | | |
| F E Warren, WY | 4,176 | 8.8 | 2.5 | 7,225 | 62.2% | 10,321 | 52.9% |
| U.S | | | | 5,979,000 | 47.4% | | |

Primary county per capita income is lowest at Whiteman AFB, at a level of approximately three-fourths of the national average, and highest at Malmstrom AFB, at nearly ninety percent (Table 3-9). Per capita income in the regions is very similar. At Malmstrom, Ellsworth, and Minot AFBs, per capita income is higher in the primary county than in the region; for the other three, the reverse is true.

**Table 3-9**
**1987 Per Capita Income by Primary County and Region**

| | PRIMARY COUNTY | % OF US | 50-MILE REGION | % OF US |
|---|---|---|---|---|
| MISSILE BASES | | | | |
| MM II | | | | |
| Ellsworth, SD | $12,975 | 83.8% | $12,173 | 78.6% |
| Malmstrom, MT | 13,724 | 88.6% | 13,695 | 88.4% |
| Whiteman, MO | 11,414 | 73.7% | 12,752 | 82.4% |
| MM III | | | | |
| Grand Forks, ND | 12,690 | 82.0% | 13,458 | 86.9% |
| Malmstrom, MT | 13,724 | 88.6% | 13,695 | 88.4% |
| Minot, ND | 12,246 | 79.1% | 12,081 | 78.0% |
| F E Warren, WY | 13,482 | 87.1% | 13,594 | 87.8% |
| Peacekeeper | | | | |
| F E Warren, WY | 13,482 | 87.1% | 13,594 | 87.8% |
| US per capita income | $15,484 | | | |

### 3.10.2.3 Economic Diversification and Historic Fluctuation

Government was the major employment sector in five primary counties, with the county containing Malmstrom AFB having services as the predominant sector (Table 3-10). In the regions surrounding Malmstrom and Whiteman AFBs, the major employment sector is services, while the remaining four regions had government as the major employment sector.

Total RTVs at the primary county level indicate that the counties containing Whiteman and F.E. Warren AFBs have experienced the widest employment swings over the twenty-year period (1967-87). At the regional level, fluctuation is more limited, with the region surrounding Ellsworth AFB showing the greatest fluctuation with an RTV of 7.218. By comparison, the US RTV value is 5.161. (Section 3.10.1.3 provides a discussion of the diversification and fluctuation measures.)

| Table 3-10<br>Employment Diversification Index, Major Employment Sector, and Sum of Absolute Values, Rational Threshold Values for Employment | | | | | | |
|---|---|---|---|---|---|---|
| | PRIMARY COUNTY | | | REGION | | |
| | Weighted Divers. Index | Max. Empl. Sector | RTV Total Absolute Value | Weighted Divers. Index | Max. Empl. Sector | RTV Total Absolute Value |
| MISSILE BASES | | | | | | |
| MM II | | | | | | |
| Ellsworth, SD | 0.6137 | G | 7.968 | 0.6749 | G | 7.218 |
| Malmstrom, MT | 0.5940 | S | 7.224 | 0.6113 | S | 6.317 |
| Whiteman, MO | 0.4322 | G | 9.724 | 0.6826 | S | 4.838 |
| MM III | | | | | | |
| Grand Forks, ND | 0.5334 | G | 5.246 | 0.6020 | G | 4.407 |
| Malmstrom, MT | 0.5940 | S | 7.224 | 0.6113 | S | 6.317 |
| Minot, ND | 0.5529 | G | 4.696 | 0.5876 | G | 4.187 |
| F E Warren, WY | 0.5631 | G | 9.148 | 0.7256 | G | 6.827 |
| Peacekeeper | | | | | | |
| F E Warren, WY | 0.5631 | G | 9.148 | 0.7256 | G | 6.827 |
| U.S | 1.0000 | S | 5.161 | | | |
| G - Government S - Service | | | | | | |

### 3.10.3 HEAVY BOMBER STORAGE, CONVERSION, OR ELIMINATION FACILITIES

The three AFBs that are potential sites for bomber storage, conversion, and elimination are located in the southwestern US. The primary county and the region defined by a fifty-mile radius are the same for Davis-Monthan AFB.

#### 3.10.3.1 Demographic Characteristics

Kelly AFB is located in a large, metropolitan area with a population of over 1 million, while the other two bases are in mid-sized counties with approximately 650,000 people. During the past decade, the Davis-Monthan AFB area had the highest population growth rate with 2.4 percent annually. All three areas experienced population growth rates above the national population growth rate of 1.0 percent annually (Table 3-11).

#### 3.10.3.2 Employment and Income

Employment growth from 1984-1989 in the counties ranged from 1.6 to 3.3 percent annually (Table 3-12). Tinker AFB experienced the lowest employment growth rate with 1.6 percent as compared to the more rapidly expanding economy in the Davis-Monthan AFB area where employment was increasing at 3.3 percent annually.

| Table 3-11 Installations--Population of Primary Counties and 50-Mile Radius Regions | | | | | | |
|---|---|---|---|---|---|---|
| | PRIMARY COUNTY | | | REGION (50-MILE RADIUS) | | |
| | Projected 1990 Popl. | Compound Growth Rate 1980-90 | Compound Growth Rate 1990-95 | Projected 1990 Popl. | Compound Growth Rate 1980-90 | Compound Growth Rate 1990-95 |
| POTENTIAL BOMBER CONVERSION OR ELIMINATION SITES | | | | | | |
| Air Bases | | | | | | |
| Davis-Monthan, AZ* | 673,397 | 2.4% | 2.1% | 673,397 | 2.4% | 2.1% |
| Kelly, TX | 1,225,742 | 2.2% | 1.6% | 1,460,534 | 2.3% | 1.7% |
| Tinker, OK | 651,052 | 1.4% | 1.0% | 1,208,301 | 1.9% | 1.5% |
| U.S. | 250,301,000 | 1.0% | 0.9% | | | |
| *Primary county and 50-mile radius region are the same | | | | | | |

| Table 3-12 Installations--Employment of Primary Counties and 50-Mile Radius Regions | | | | | | |
|---|---|---|---|---|---|---|
| | PRIMARY COUNTY | | | REGION (50-MILE RADIUS) | | |
| | Projected 1989 Empl. | Compound Growth Rate 1984-89 | Compound Growth Rate 1989-95 | Projected 1989 Empl. | Compound Growth Rate 1984-89 | Compound Growth Rate 1989-95 |
| POTENTIAL BOMBER CONVERSION OR ELIMINATION SITES | | | | | | |
| Air Bases | | | | | | |
| Davis-Monthan, AZ* | 317,835 | 3.3% | 2.8% | 317,835 | 3.3% | 2.8% |
| Kelly, TX | 620,406 | 2.0% | 2.1% | 109,231 | 2.0% | 2.2% |
| Tinker, OK | 476,656 | 1.6% | 2.0% | 670,759 | 1.7% | 2.1% |
| U.S. | 131,121,000 | 1.9% | 1.6% | | | |
| *Primary county and 50-mile radius region are the same | | | | | | |

| Table 3-13 Base Employment and Total Federal Government Employment | | | | |
|---|---|---|---|---|
| | COUNTY | | REGION | |
| | Federal Empl. Total | Military % of all Federal | Federal Empl. Total | Military % of all Federal |
| POTENTIAL BOMBER CONVERSION OR ELIMINATION SITES | | | | |
| Air Bases | | | | |
| Davis-Monthan, AZ* | 15,658 | 50.9% | 15,658 | 50.9% |
| Kelly, TX | 89,193 | 49.5% | 90,523 | 49.7% |
| Tinker, OK | 42,422 | 29.9% | 48,715 | 34.6% |
| *Primary county and 50-mile radius region are the same | | | | |

Military employment, as a percent of all federal employment, was average at both the county and regional level, ranging from almost one-third to one-half (Table 3-13).

County per capita income for 1987 ranged from 83 percent at Kelly AFB to Tinker's nearly 94 percent of the US average of $15,584 (Table 3-14). Regional per capita income was virtually the same as for the primary county, except for the region containing Tinker AFB

| Table 3-14<br>1987 Per Capita Income by Primary County and Region | | | | |
|---|---|---|---|---|
| | PRIMARY COUNTY | % OF US | 50-MILE REGION | % OF US |
| POTENTIAL BOMBER CONVERSION OR ELIMINATION SITES | | | | |
| Air Bases | | | | |
| Davis-Monthan, AZ* | $13,845 | 89.4% | $13,845 | 89.4% |
| Kelly, TX | 12,826 | 82.8% | 12,796 | 82.6% |
| Tinker, OK | 14,540 | 93.9% | 13,381 | 86.4% |
| US per capita income | $15,484 | | | |
| *Primary county and 50-mile radius region are the same | | | | |

which had a lower regional per capita income than was evident at the primary-county level.

### 3.10.3.3 Economic Diversification and Historic Fluctuation

Primary counties had diversification index values of approximately 75 percent of the national level, indicating healthy economic diversity. (Section 3.10.1.3 provides a discussion of the diversification and fluctuation measures.) The multi-county regions surrounding Tinker and Kelly AFBs display even greater diversity. In the primary county containing Kelly AFB, the sector of maximum employment is government, while it is services for the remaining areas. Primary county and regional RTVs indicate moderate employment fluctuation over the past two decades (Table 3-15).

| Table 3-15<br>Employment Diversification Index, Major Employment Sector, and Sum of Absolute Values, Rational Threshold Values for Employment | | | | | | |
|---|---|---|---|---|---|---|
| | PRIMARY COUNTY | | | REGION | | |
| | Weighted Divers. Index | Max. Empl. Sector | RTV Total Absolute Value | Weighted Divers. Index | Max. Empl. Sector | RTV Total Absolute Value |
| POTENTIAL BOMBER CONVERSION OR ELIMINATION SITES | | | | | | |
| Air Bases | | | | | | |
| David-Monthan, AZ* | 0.7575 | S | 8.186 | 0.7575 | S | 8.186 |
| Kelly, TX | 0.8050 | G | 6.862 | 0.8338 | S | 6.464 |
| Tinker, OK | 0.7492 | S | 7.855 | 0.8351 | S | 7.566 |
| U.S. | 1.0000 | 70 | 5.161 | | | |
| G - Government S - Service M - Manufacturing<br>*Primary county and 50-mile radius region are the same | | | | | | |

## 3.10.4 MISSILE STORAGE, CONVERSION, OR ELIMINATION FACILITIES

The eight potential facilities identified for missile storage, conversion, or elimination are located across the southern tier of the US, but are mostly concentrated in the Southwest.

The primary county and the region defined by a fifty-mile radius are the same for the elimination facilities at the Hawthorne Army Ammunitions Plant.

### 3.10.4.1 Demographic Characteristics

Population size for the eight primary counties varies widely from the Hawthorne facility located in a county with a population of fewer than 6,000 to Cape Canaveral and Vandenberg with populations of approximately 350,000 people. Primary county population growth rates for the 1980-1990 decade indicated that only the Hawthorne area experienced a population decline. Sierra and Cape Canaveral were the only two primary county markets experiencing annual growth rates of over two percent annually over the past decade. Growth rates for 1990-1995 are projected to be slightly lower than experienced over the past decade. Population trends in the regions closely represent trends and projections for the primary counties (Table 3-16).

**Table 3-16**
**Installations--Population of Primary Counties and 50-Mile Radius Regions**

| | PRIMARY COUNTY | | | REGION (50-MILE RADIUS) | | |
|---|---|---|---|---|---|---|
| | Projected 1990 Popl. | Compound Growth Rate | | Projected 1990 Popl. | Compound Growth Rate | |
| | | 1980-90 | 1990-95 | | 1980-90 | 1990-95 |
| CONVERSION OR ELIMINATION FACILITIES | | | | | | |
| Hawthorne, NV* | 5,647 | -1.0% | -1.1% | 5,647 | -1.0% | -1.1% |
| Hill, UT | 166,467 | 1.4% | 1.2% | 1,299,255 | 2.2% | 1.9% |
| Longhorn, TX | 61,788 | 1.7% | 1.4% | 772,534 | 1.5% | 1.3% |
| Pueblo, CO | 129,422 | 0.3% | 0.3% | 591,036 | 1.9% | 1.4% |
| Sierra, CA | 27,226 | 2.3% | 1.9% | 308,711 | 2.7% | 2.4% |
| Tooele, UT | 31,318 | 1.9% | 1.5% | 1,308,138 | 2.4% | 2.1% |
| Cape Canaveral, FL | 375,035 | 3.2% | 2.1% | 554,897 | 3.8% | 2.5% |
| Vandenberg, CA | 347,933 | 1.5% | 1.2% | 561,412 | 2.1% | 1.7% |
| U.S. | 250,301,000 | 1.0% | 0.9% | | | |

*Primary county and 50-mile radius region are the same

### 3.10.4.2 Employment and Income Characteristics

The potential conversion or elimination facilities were very diverse in employment size and growth rates during the 1984-1989 time period. Two of the primary counties had employment concentrations in excess of 175,000 workers in 1989. With the exception of Hawthorne, which experienced a decline in employment, the other areas experienced employment increases varying from 0.8 percent to a high of 2.7 percent at Vandenberg. Employment growth rates are expected to decline slightly during the 1990-1995 time period (Table 3-17).

Military employment, as a percent of federal employment, varied widely in the primary counties, from 8 percent in the Tooele, UT area to approximately 64 percent in the

| Table 3-17<br>Installations--Employment of Primary Counties and Regions | | | | | | |
|---|---|---|---|---|---|---|
| | PRIMARY COUNTY | | | REGION (50-MILE RADIUS) | | |
| | Projected 1989 Empl. | Compound Growth Rate | | Projected 1989 Empl. | Compound Growth Rate | |
| | | 1984-89 | 1989-95 | | 1984-89 | 1989-95 |
| CONVERSION OR ELIMINATION FACILITIES | | | | | | |
| Hawthorne, NV* | 2,795 | -1.6% | -0.3% | 2,795 | -1.6% | -0.3% |
| Hill, UT | 74,072 | 2.4% | 2.0% | 654,570 | 2.8% | 2.4% |
| Longhorn, TX | 25,460 | 0.9% | 1.4% | 367,326 | 1.7% | 1.8% |
| Pueblo, CO | 51,006 | 1.4% | 0.3% | 306,315 | 2.3% | 2.2% |
| Sierra, CA | 10,091 | 2.0% | 1.7% | 190,749 | 2.9% | 2.8% |
| Tooele, UT | 12,929 | 0.8% | 0.9% | 635,661 | 2.8% | 2.4% |
| Cape Canaveral, FL | 176,705 | 2.2% | 2.6% | 252,454 | 2.8% | 2.9% |
| Vandenberg, CA | 210,914 | 2.7% | 2.3% | 304,691 | 2.9% | 2.6% |
| U.S. | 131,121,000 | 1.9% | 1.6% | | | |

*Primary county and 50-mile radius region are the same

Longhorn, TX area. The highest number of total federal employees on a regional basis was located at Hill and Pueblo with approximately 50,000 employees (Table 3-18).

The 1987 per capita income by primary county and region for potential conversion or elimination facilities is shown in Table 3-19. Within the primary county and fifty - mile radius, Vandenberg experienced the highest per capita income.

### 3.10.4.3 Economic Diversification and Historic Fluctuation

The primary counties varied significantly, with index values indicating from very weak to very healthy economic diversity in the eight locations. (Section 3.10.1.3 provides a discussion of the economic diversification and fluctuation measures.) The single-county region surrounding the Hawthorne facility showed the least diversity, with services as the primary sector of employment. Hawthorne also experienced the greatest amount of economic fluctuation in the last two decades with a RTV of 19.9. In the multi-county regions, six of the eight regions had economic diversity indices of 75 percent or greater showing economic diversity characteristics mirroring the national economy which has an index value of 1.0. The regional sector of maximum employment was services in all counties except for the region containing the Pueblo facility where government was the dominant source of employment.

| Table 3-18<br>Base Employment and Total Federal Government Employment | | | | |
|---|---|---|---|---|
| | COUNTY | | REGION | |
| | Federal Empl. Total | Military % of all Federal | Federal Empl. Total | Military % of all Federal |
| CONVERSION OR ELIMINATION FACILITIES | | | | |
| Hawthorne, NV* | 152 | 16.4% | 152 | 16.4% |
| Hill, UT | 8,825 | 14.6% | 50,684 | 28.4% |
| Longhorn, TX | 344 | 64.0% | 15,608 | 62.7% |
| Pueblo, CO | 2,125 | 38.9% | 48,215 | 75.8% |
| Sierra, CA | 1,572 | 27.2% | 5,928 | 21.6% |
| Tooele, UT | 5,566 | 8.0% | 43,426 | 32.5% |
| Cape Canaveral, FL | 10,787 | 45.2% | 11,650 | 45.1% |
| Vandenberg, CA | 9,651 | 56.0% | 11,008 | 55.2% |
| U.S. | 5,979,000 | 47.4% | | |

*Primary county and 50-mile radius region are the same

| Table 3-19<br>1987 Per Capita Income by Primary County and Region | | | | |
|---|---|---|---|---|
| | PRIMARY COUNTY | % OF US | 50-MILE REGION | % OF US |
| CONVERSION OR ELIMINATION FACILITIES | | | | |
| Hawthorne, NV* | $13,425 | 86.7% | 13,425 | 86.7% |
| Hill, UT | 12,622 | 84.5% | 12,250 | 79.1% |
| Longhorn, TX | 11,444 | 73.9% | 12,368 | 79.9% |
| Pueblo, CO | 11,444 | 73.9% | 13,599 | 87.8% |
| Sierra, CA | 11,490 | 74.2% | 17,233 | 111.3% |
| Tooele, UT | 11,580 | 74.8% | 11,605 | 74.9% |
| Cape Canaveral, FL | 14,650 | 94.6% | 15,171 | 98.0% |
| Vandenberg, CA | 18,909 | 122.1% | 17,281 | 111.6% |
| US per capita income | $15,484 | | | |

*Primary county and 50-mile radius region are the same

Primary county RTVs indicate very extensive employment fluctuations over the past two decades in the counties containing the Hawthorne, Longhorn, and Cape Canaveral facilities. It is not surprising that the Hawthorne facility's small, single-county region with weak diversification has experienced the greatest amount of economic fluctuation over the past two decades (Table 3-20).

## Table 3-20
## Employment Diversification Index, Major Employment Sector, and Sum of Absolute Values, Rational Threshold Values for Employment

| | PRIMARY COUNTY | | | REGION | | |
|---|---|---|---|---|---|---|
| | Weighted Diver. Index | Max. Empl. Sector | RTV Total Abs. Value | Weighted Div. Index | Max. Empl. Sector | RTV Total Abs. Value |
| CONVERSION OR ELIMINATION FACILITIES | | | | | | |
| Hawthorne, NV* | 0.1738 | S | 19.989 | 0.1738 | S | 19.989 |
| Hill, UT | 0.6525 | S | 6.669 | 0.8649 | S | 4.904 |
| Longhorn, TX | 0.5146 | M | 12.001 | 0.7832 | S | 7.170 |
| Pueblo, CO | 0.5913 | S | 8.594 | 0.7860 | G | 7.889 |
| Sierra, CA | 0.4034 | G | 7.608 | 0.7663 | S | 13.614 |
| Tooele, UT | 0.3033 | G | 8.532 | 0.8612 | S | 5.483 |
| Cape Canaveral, FL | 0.6632 | S | 13.793 | 0.7425 | S | 13.574 |
| Vandenberg, CA | 0.7669 | S | 7.941 | 0.8142 | S | 7.038 |
| US per capita income | 1.0000 | 70 | 5.161 | | | |

*Primary county and 50-mile radius region are the same

# 4.0 ENVIRONMENTAL CONSEQUENCES

This chapter discusses the potential impacts of the proposed action and alternatives. The general methods of analyzing impacts on resource areas are introduced at the beginning of each section, followed by potential measures that could mitigate the possible impacts.

A structured analysis process was used to identify potential environmental effects of Treaty activities. First, the range of activities that could be included within the Treaty implementation program were diagrammed in sequential form: "Activity A would be followed by Activity B, which would be followed by C or D" and so on. This first step of the analysis is shown in Figure 4-1.

Next, an interdisciplinary team scrutinized each activity to identify what conceivable direct effects could occur in each resource area from each activity. The thrust in this step was to identify, and diagram, potential effects, not to ascertain that they would occur, nor to measure them or assess their significance.

The next step was to identify further sequences of causes and effects. In many cases, a direct environmental effect from an activity has the potential to cause other environmental effects, often in other resource areas.

The next step was to identify the key questions to direct, focus, or temper the detailed analysis. Such questions aided the team in seeking information and conducting analysis relevant to the significant issues at hand.

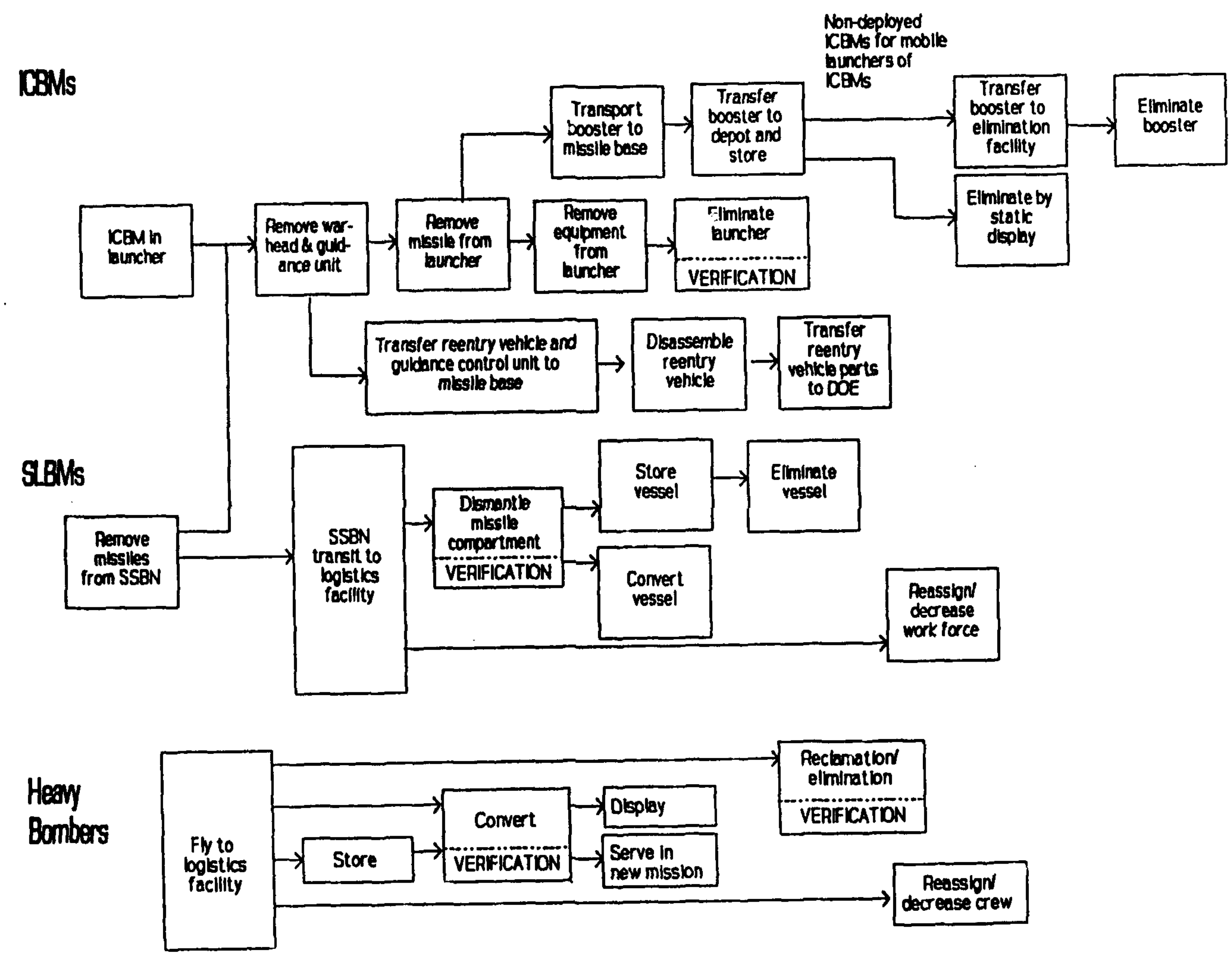
Figure 4-2 is a generic model of the kind of diagram resulting from this "Cause-Effect-Question" process. Figures 4-3, 4-4, 4-6, and 4-7 are the diagrams developed from each of the major Treaty activities. Figure 4-5 shows activities that would not be required by the Treaty, but are options for reducing the number of boosters that would be removed from deployed status as a result of the Treaty. Conceivable effects that could result from the construction of PPCM facilities at rocket motor production sites would be similar to those identified in Figure 4-3 under the heading "Store."

Established Federal regulations and guidelines, data and information from past and current practices, and professional judgement were used to derive preliminary impact criteria and to estimate the significance of potential environmental impacts. The programmatic nature of this document allows discussion of likely impact areas, the types of impacts that may occur, and possible mitigation measures. Site-specific impacts, with detailed, quantified analyses, will be addressed as appropriate in subsequent tiers of environmental studies.

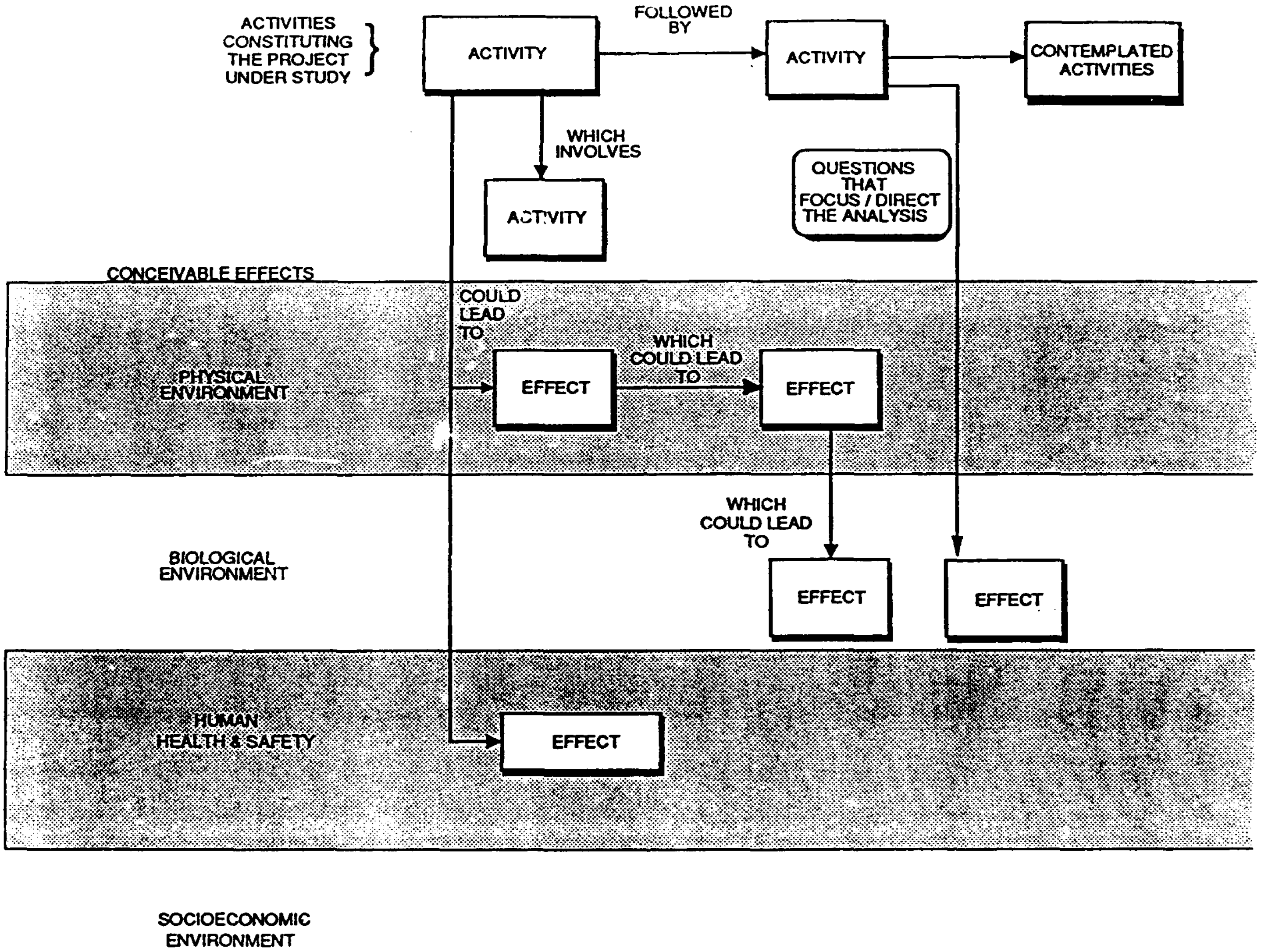
A discussion of cumulative impacts is presented in Section 4.11 while Section 4.12 considers any adverse environmental effects that cannot be avoided should the Treaty be ratified. Section 4.13 describes the potential permanent commitments of resources.

The relationship between short-term uses of resources and maintenance of long-term productivity is discussed in Section 4.14.

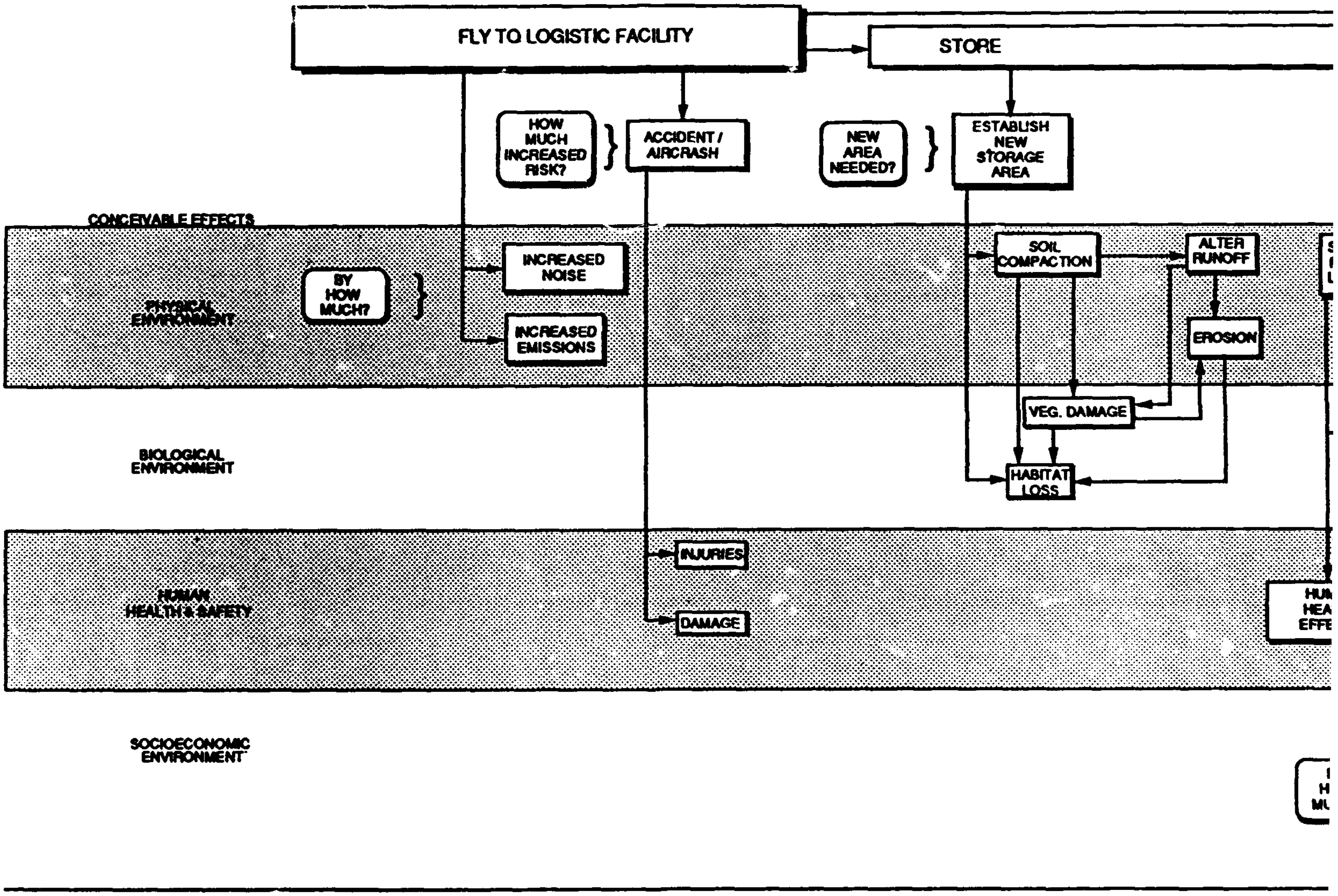
**Figure 4-1**
**Overview of Removal of Strategic Systems from Deployed Service**



## Figure 4-2 Model Cause Effect Investigation Network



## Figure 4-3 Heavy Bomber Storage/Conversion/Elimination



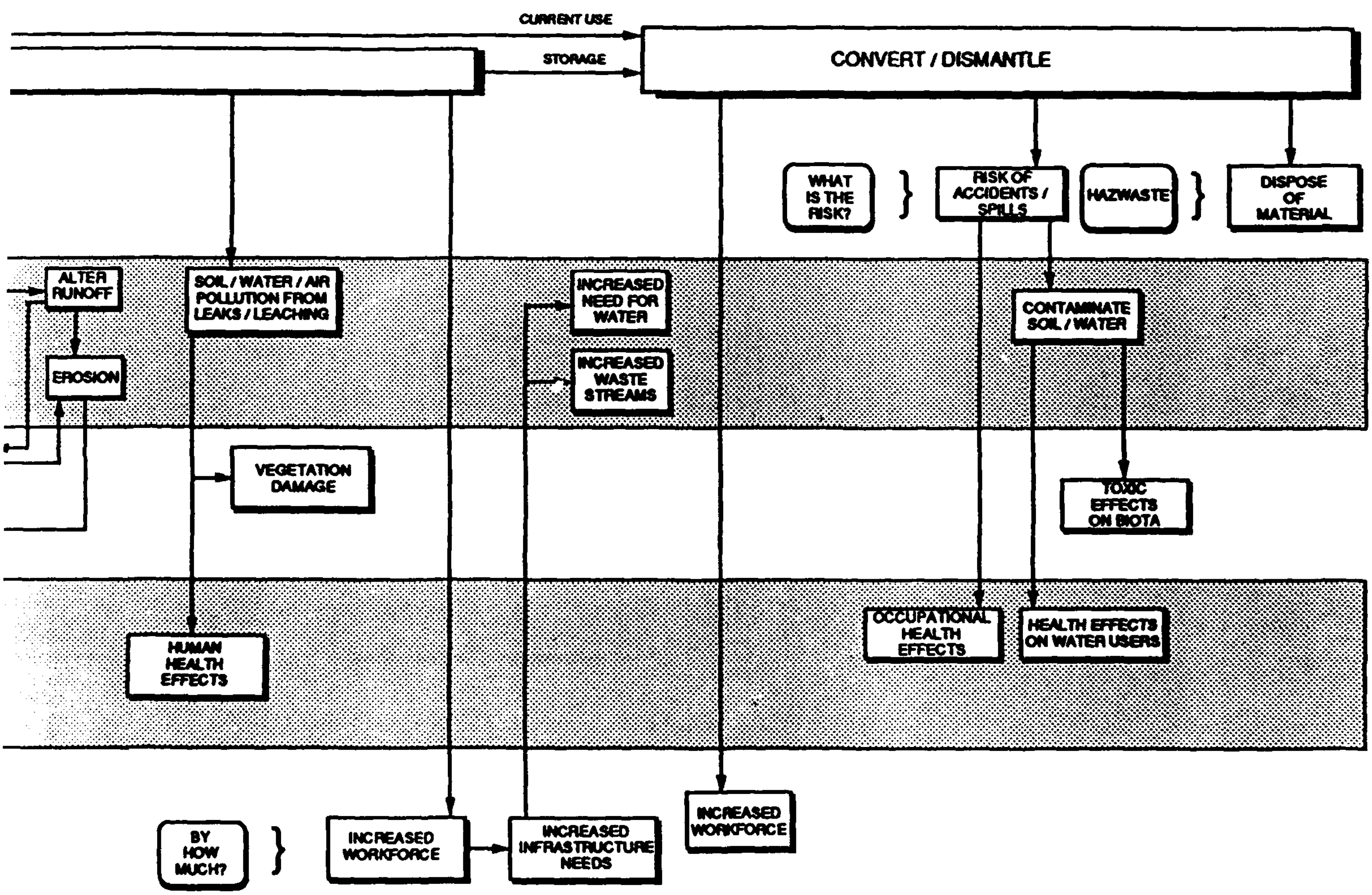
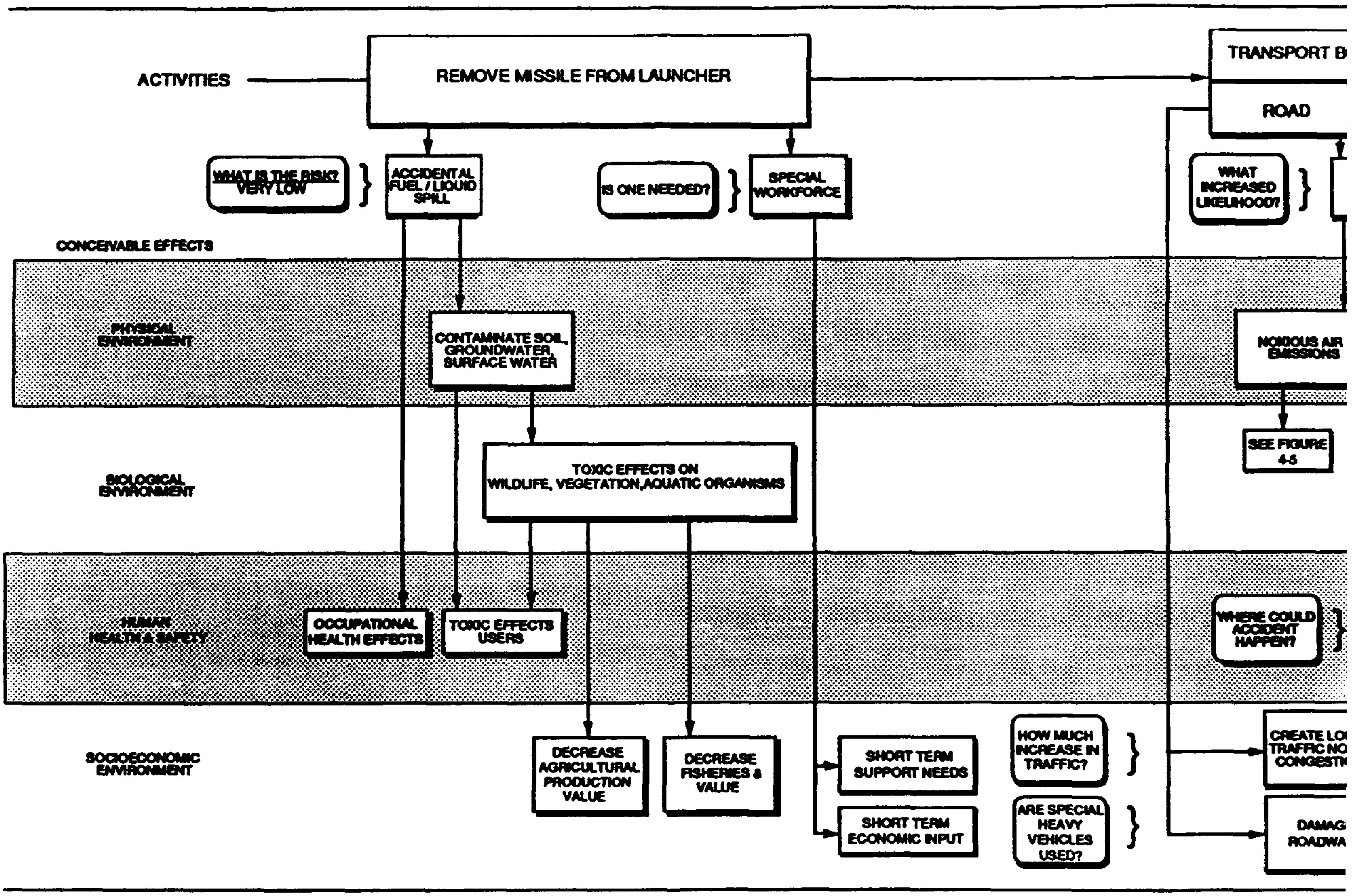
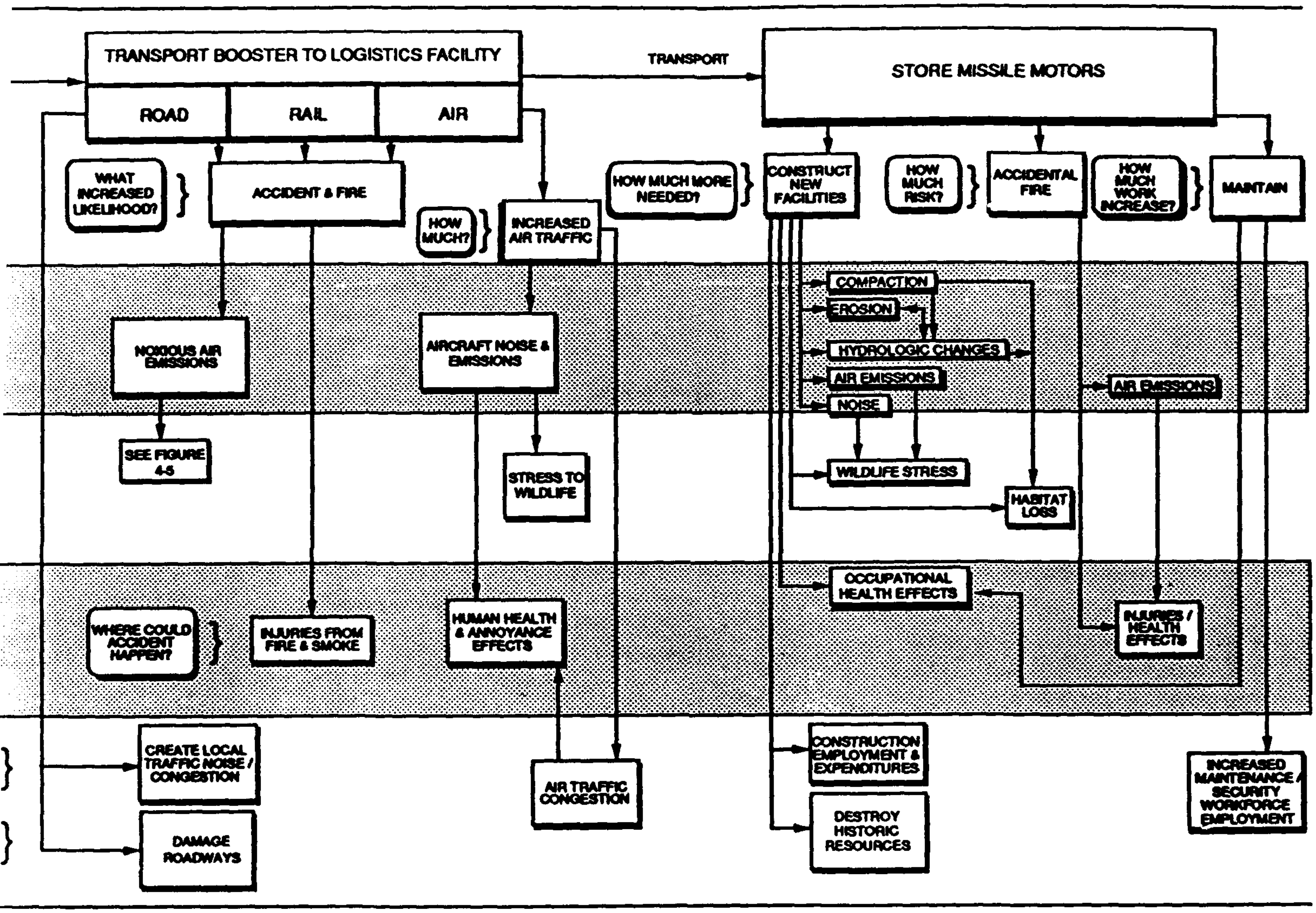

CURRENT USE
STORAGE
CONVERT / DISMANTLE
WHAT IS THE RISK?
RISK OF ACCIDENTS / SPILLS
HAZWASTE
DISPOSE OF MATERIAL
ALTER RUNOFF
SOIL / WATER / AIR POLLUTION FROM LEAKS / LEACHING
INCREASED NEED FOR WATER
INCREASED WASTE STREAMS
CONTAMINATE SOIL / WATER
EROSION
VEGETATION DAMAGE
TOXIC EFFECTS ON BIOTA
OCCUPATIONAL HEALTH EFFECTS
HEALTH EFFECTS ON WATER USERS
HUMAN HEALTH EFFECTS
BY HOW MUCH?
INCREASED WORKFORCE
INCREASED INFRASTRUCTURE NEEDS
INCREASED WORKFORCE

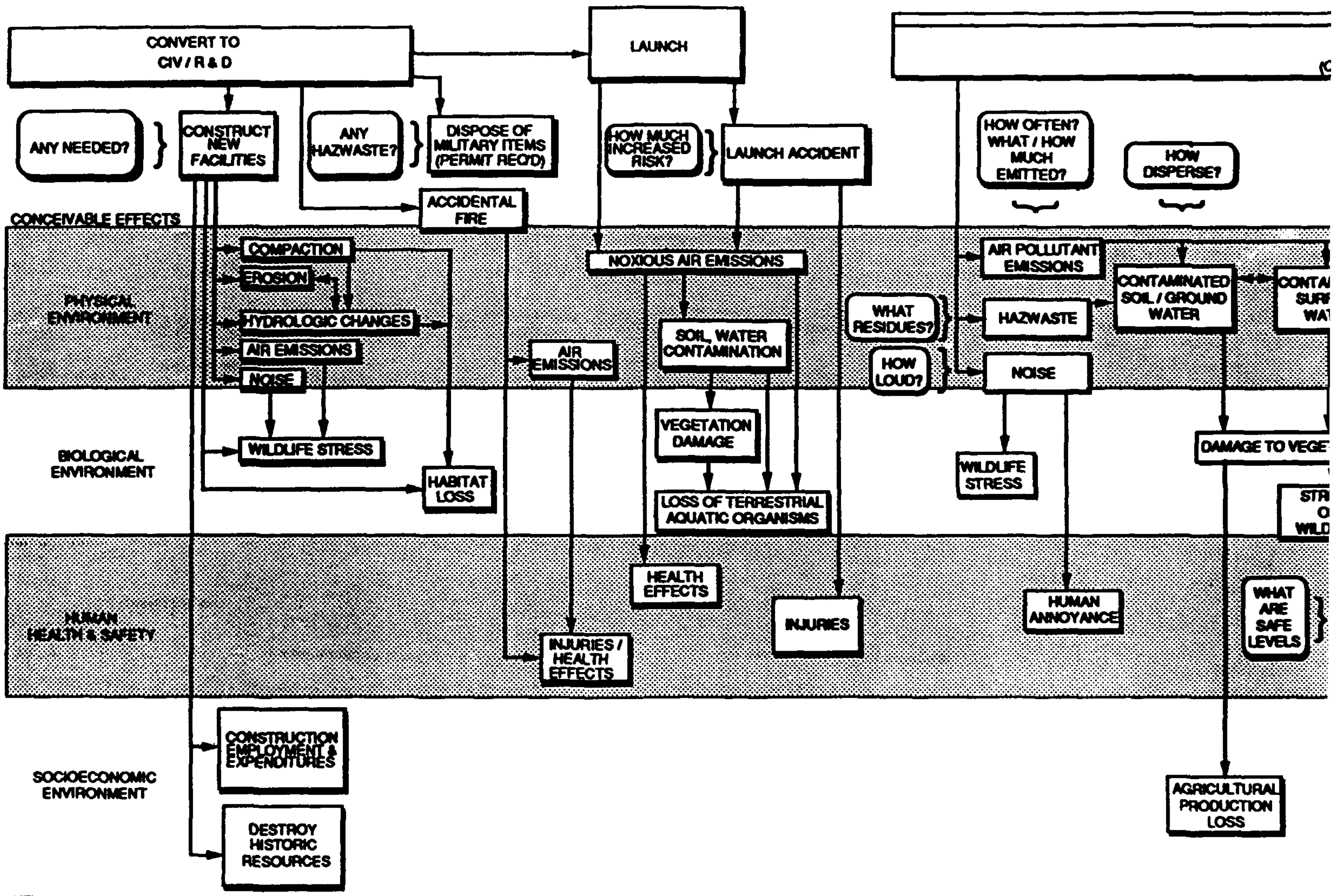
**Figure 4-4 Missile Transportation/Storage**





TRANSPORT BOOSTER TO LOGISTICS FACILITY
TRANSPORT
STORE MISSILE MOTORS
ROAD
RAIL
AIR
WHAT INCREASED LIKELIHOOD?
ACCIDENT & FIRE
HOW MUCH?
INCREASED AIR TRAFFIC
HOW MUCH MORE NEEDED?
CONSTRUCT NEW FACILITIES
HOW MUCH RISK?
ACCIDENTAL FIRE
HOW MUCH WORK INCREASE?
MAINTAIN
COMPACTION
EROSION
HYDROLOGIC CHANGES
AIR EMISSIONS
NOISE
AIR EMISSIONS
NOXIOUS AIR EMISSIONS
AIRCRAFT NOISE & EMISSIONS
SEE FIGURE 4-5
STRESS TO WILDLIFE
WILDLIFE STRESS
HABITAT LOSS
OCCUPATIONAL HEALTH EFFECTS
WHERE COULD ACCIDENT HAPPEN?
INJURIES FROM FIRE & SMOKE
HUMAN HEALTH & ANNOYANCE EFFECTS
INJURIES / HEALTH EFFECTS
CREATE LOCAL TRAFFIC NOISE / CONGESTION
AIR TRAFFIC CONGESTION
CONSTRUCTION EMPLOYMENT & EXPENDITURES
INCREASED MAINTENANCE / SECURITY WORKFORCE EMPLOYMENT
DAMAGE ROADWAYS
DESTROY HISTORIC RESOURCES

**Figure 4-5 Missile Motor Elimination**



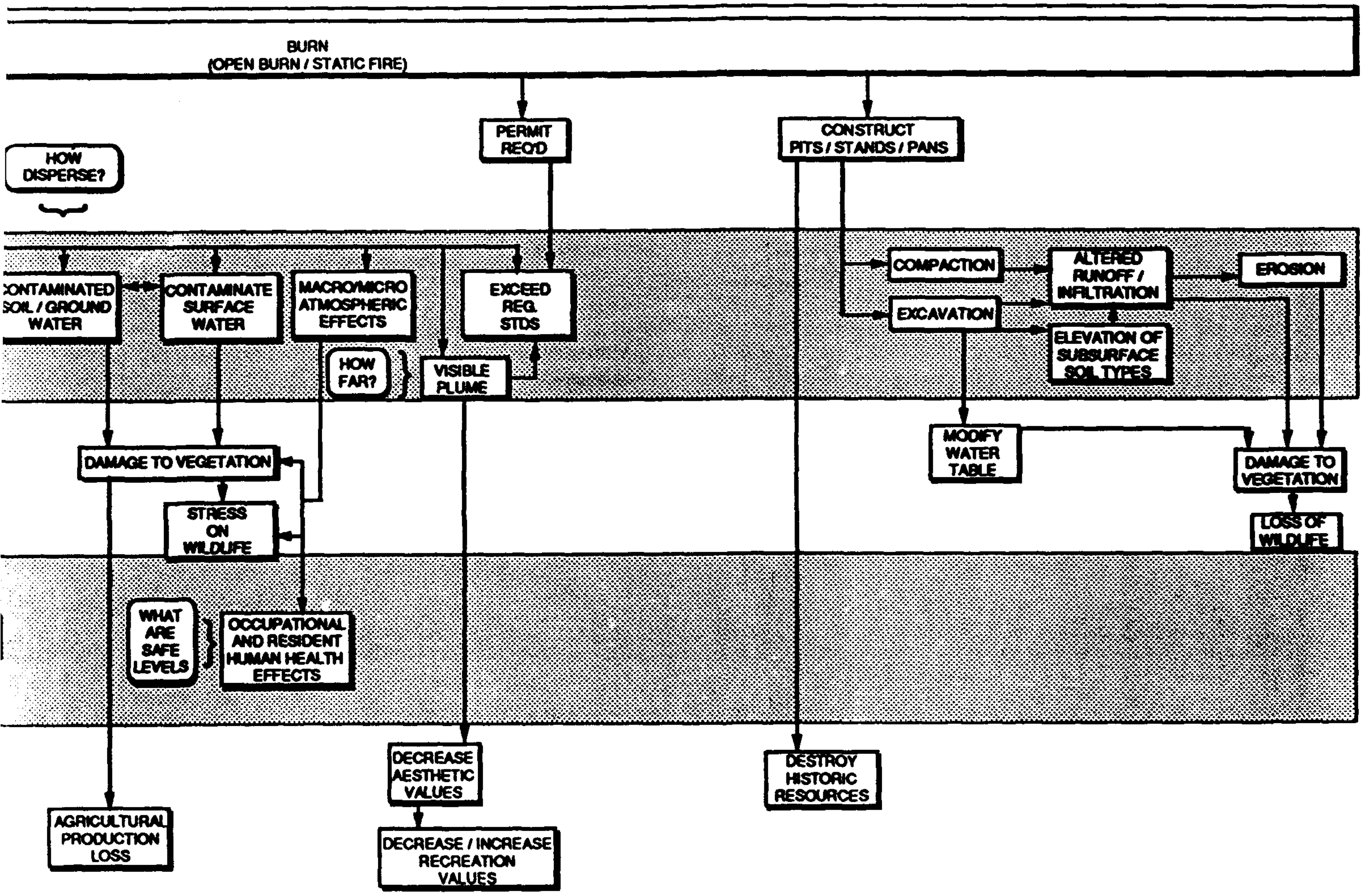
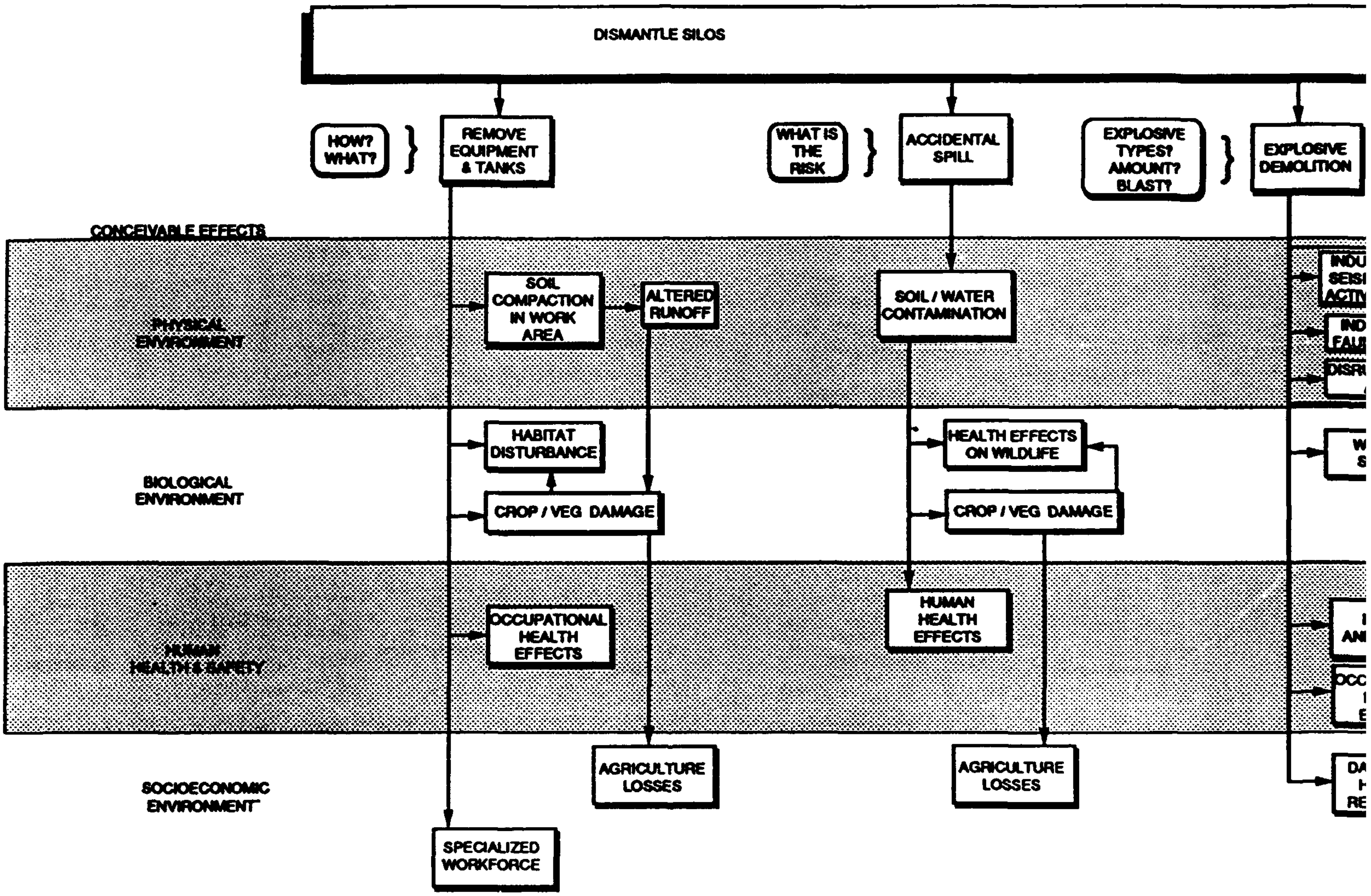
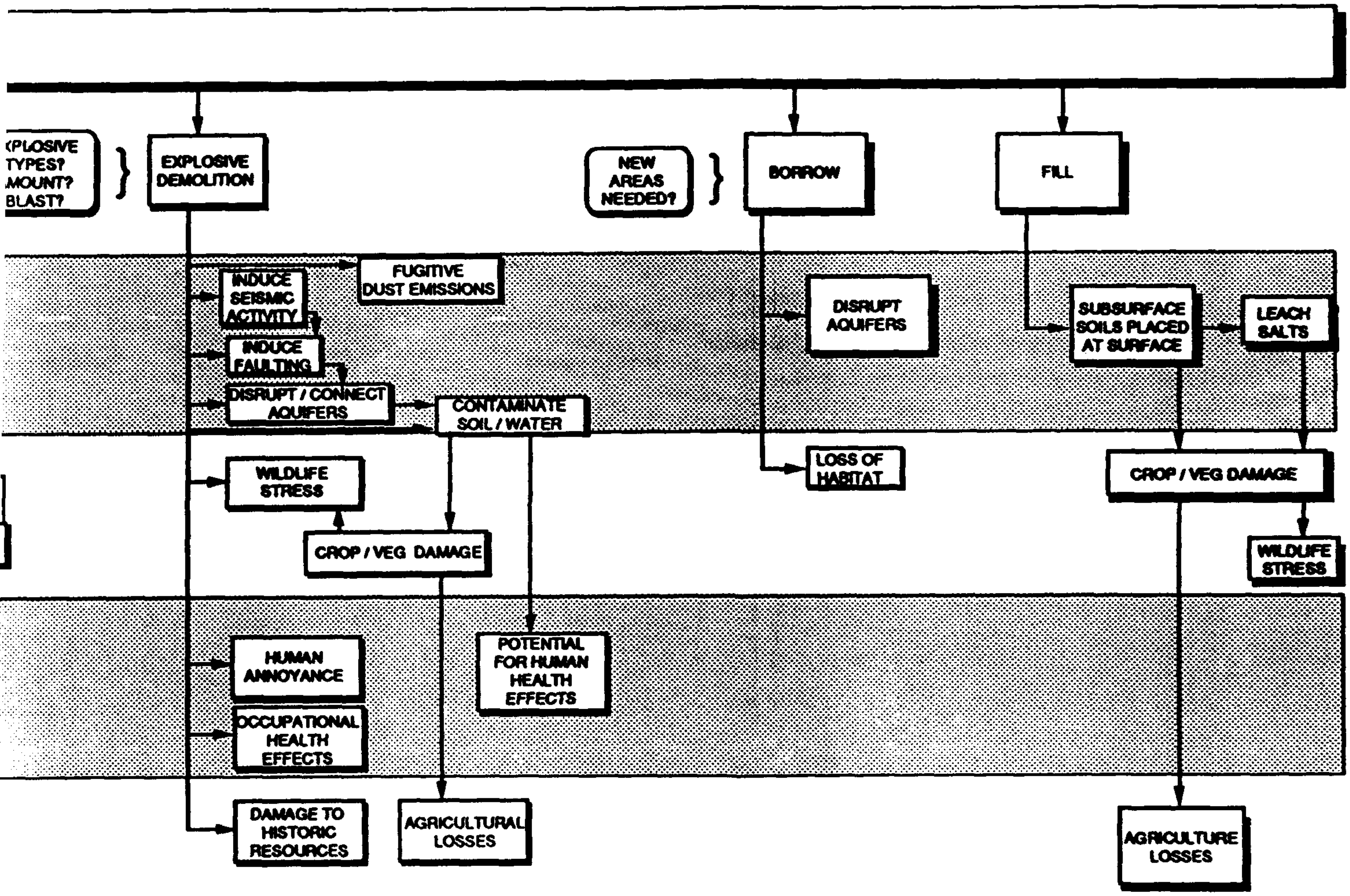

BURN
(OPEN BURN / STATIC FIRE)
PERMIT REQ'D
CONSTRUCT PITS / STANDS / PANS
HOW DISPERSE?
CONTAMINATED SOIL / GROUND WATER
CONTAMINATE SURFACE WATER
MACRO/MICRO ATMOSPHERIC EFFECTS
EXCEED REG. STDS
HOW FAR?
VISIBLE PLUME
COMPACTION
EXCAVATION
ALTERED RUNOFF / INFILTRATION
ELEVATION OF SUBSURFACE SOIL TYPES
EROSION
MODIFY WATER TABLE
DAMAGE TO VEGETATION
STRESS ON WILDLIFE
DAMAGE TO VEGETATION
LOSS OF WILDLIFE
WHAT ARE SAFE LEVELS
OCCUPATIONAL AND RESIDENT HUMAN HEALTH EFFECTS
DECREASE AESTHETIC VALUES
DECREASE / INCREASE RECREATION VALUES
DESTROY HISTORIC RESOURCES
AGRICULTURAL PRODUCTION LOSS

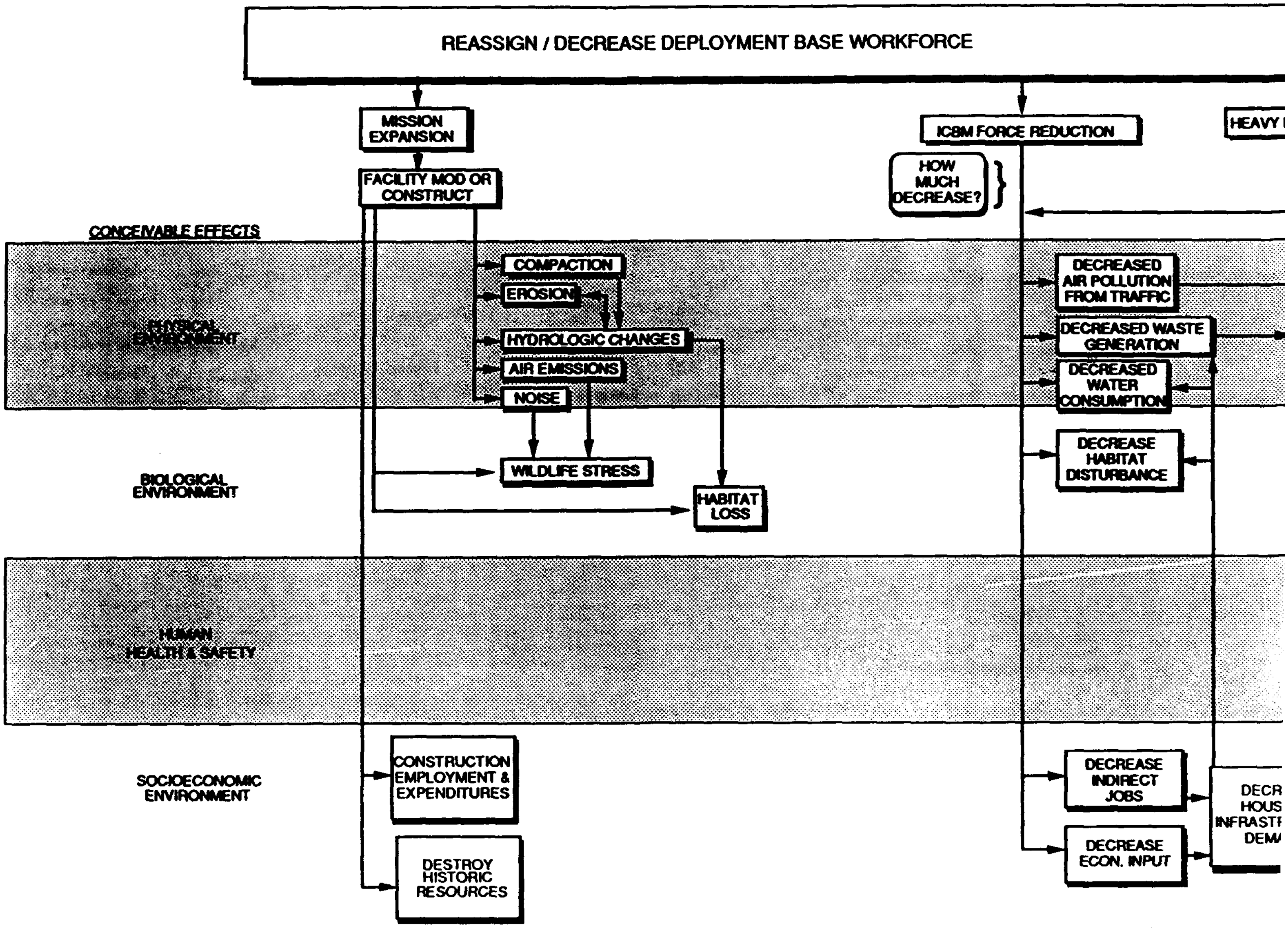
Figure 4-6 Silo Elimination

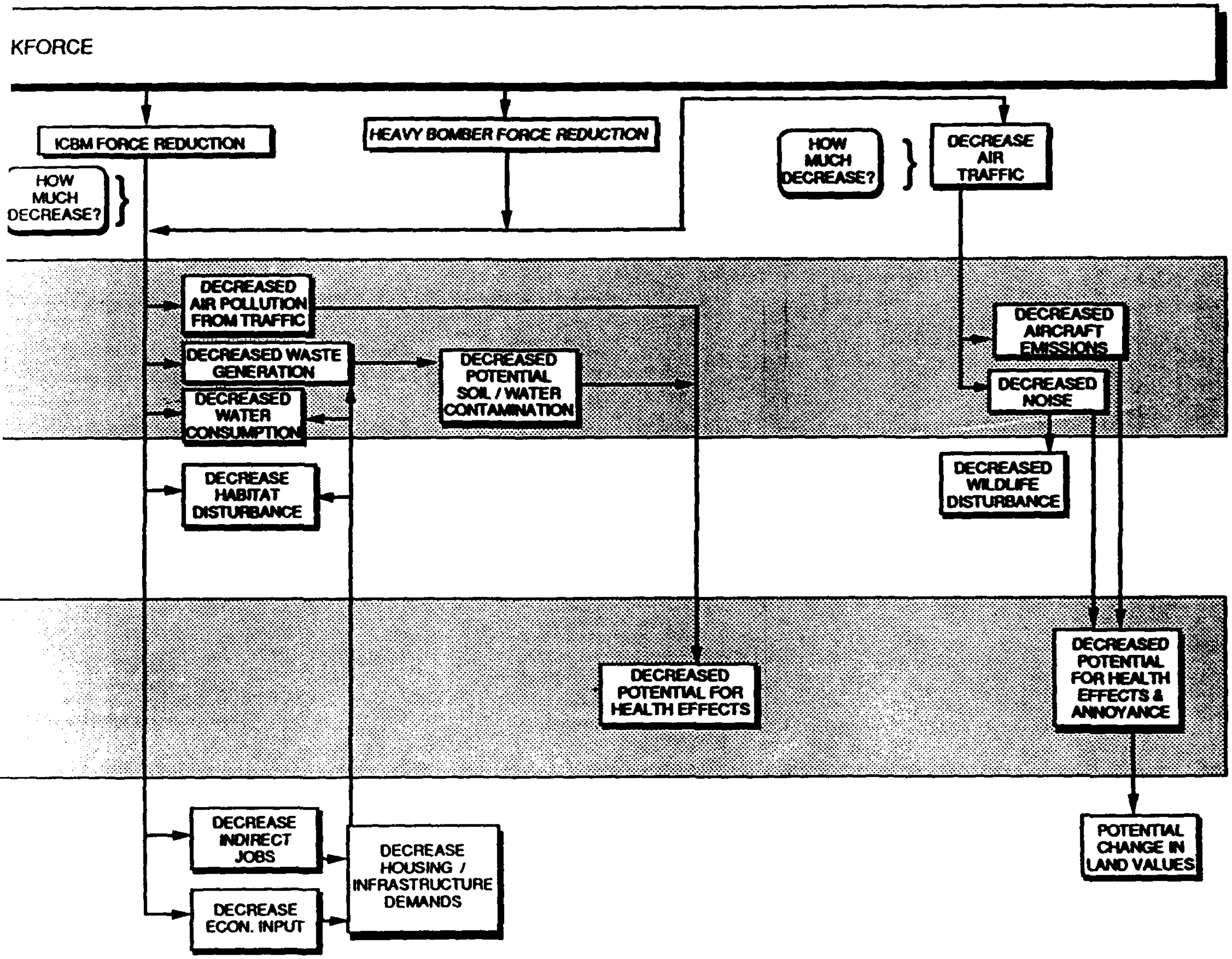




XPLOSIVE TYPES? AMOUNT? BLAST?
EXPLOSIVE DEMOLITION
NEW AREAS NEEDED?
BORROW
FILL
FUGITIVE DUST EMISSIONS
INDUCE SEISMIC ACTIVITY
INDUCE FAULTING
DISRUPT / CONNECT AQUIFERS
CONTAMINATE SOIL / WATER
DISRUPT AQUIFERS
SUBSURFACE SOILS PLACED AT SURFACE
LEACH SALTS
WILDLIFE STRESS
CROP / VEG DAMAGE
LOSS OF HABITAT
CROP / VEG DAMAGE
WILDLIFE STRESS
HUMAN ANNOYANCE
POTENTIAL FOR HUMAN HEALTH EFFECTS
OCCUPATIONAL HEALTH EFFECTS
DAMAGE TO HISTORIC RESOURCES
AGRICULTURAL LOSSES
AGRICULTURE LOSSES

**Figure 4-7 Workforce**




KFORCE
ICBM FORCE REDUCTION
HEAVY BOMBER FORCE REDUCTION
HOW MUCH DECREASE?
HOW MUCH DECREASE?
DECREASE AIR TRAFFIC
DECREASED AIR POLLUTION FROM TRAFFIC
DECREASED WASTE GENERATION
DECREASED POTENTIAL SOIL / WATER CONTAMINATION
DECREASED WATER CONSUMPTION
DECREASE HABITAT DISTURBANCE
DECREASED AIRCRAFT EMISSIONS
DECREASED NOISE
DECREASED WILDLIFE DISTURBANCE
DECREASED POTENTIAL FOR HEALTH EFFECTS
DECREASED POTENTIAL FOR HEALTH EFFECTS & ANNOYANCE
POTENTIAL CHANGE IN LAND VALUES
DECREASE INDIRECT JOBS
DECREASE ECON. INPUT
DECREASE HOUSING / INFRASTRUCTURE DEMANDS

## 4.1 AIR QUALITY

### 4.1.1 HEAVY BOMBER DEPLOYMENT BASES

#### 4.1.1.1 Analysis Methods

The analysis for this portion of the document was based on a review of existing data and publications for the potentially affected locations. The review covered, but not exclusively, NEPA and IRP documents, base comprehensive plans, EPA regulations, and available aircraft emissions from the Aircraft Engine Emissions Estimator. The review centered on whether the bases were in attainment status with the NAAQS, the current force structure, proximity of major sources of pollutants such as metropolitan areas, and the local meteorological conditions.

Identification of actual impacts to air quality will occur at the site-specific level of analysis. This would involve collecting data from air monitoring stations; utilizing mathematical dispersion models; utilizing the Aircraft Engine Emissions Estimator to determine emission pollutant amounts; interviews with operations personnel to define the level of flying activity; and evaluating other mobile and stationary sources of emissions.

#### 4.1.1.2 Potential Impacts

As stated previously in Section 3.1.1, aircraft primarily emit HC, $NO_x$, $SO_2$, CO, and PM. Although mobile sources of pollutants are not specifically regulated or permitted, the emissions contribute to the overall levels of criteria pollutants within a given region or air basin. A withdrawal of aircraft from a base will result in fewer criteria pollutant emissions and a long-term beneficial impact on the air quality in the vicinity of the deployment base.

The significance of the impact will depend on the number of aircraft that will be removed from any given location, and the resulting decrease in flying activity, along with the existing air quality conditions. If a number of planes were to be removed from a location with fairly pristine air quality, the level of impact - although beneficial - could be low or negligible because the existing operations are not currently having a significant impact on the resource. The same analysis could be used to determine the level of impact for those locations where the air quality is dictated by the adjacent metropolitan area. The beneficial impact could, again, be low or negligible because the existing impact on the resource is not currently due to AF operations.

#### 4.1.1.3 Potential Mitigation

The impacts resulting from the proposed action are expected to be beneficial in nature; thus, no potential mitigation is anticipated.

### 4.1.2 ICBM DEPLOYMENT BASES

#### 4.1.2.1 Analysis Methods

The analysis to determine potential impacts at the ICBM deployment bases was similar to the analysis used at the heavy bomber deployment bases. See Section 4.1.1.1 for this discussion. Additional analysis for this section included a data review for emissions from construction activities and explosives, and a review of the current level of vehicular traffic at the sites.

Identification of actual impacts to air quality will occur at the site-specific level of analysis. Analysis methods, similar to what appears in Section 4.1.1.1, will involve interviews with knowledgeable personnel to define the level of maintenance and transport activity, and estimating total site construction emissions, including explosives, rather than estimating aircraft emissions.

#### 4.1.2.2 Potential Impacts

Activity will increase around the launch facilities during the dismantling and restoration of the site. Additional vehicular traffic, heavy equipment, construction activities, and explosives will all increase the amounts of air pollutant emissions in the area. Exhaust from vehicles and heavy equipment include CO, $NO_x$, HCs, and suspended PM. Pollutants from explosives, most likely TNT, include CO, $NO_x$, and dust, and construction activities will also create additional fugitive dust. Although construction-related emissions are generally exempt from federal, state, and local regulatory review, the EPA still requires that such activities not exceed the NAAQS.

The increased air pollutant emissions will cause a short-term, adverse impact on the resource in the area of the silos. The level of significance will depend on the magnitude and timing of the construction activity. When compared with estimated construction emissions from other activities, the impact will likely be low based on the dismantling and restoration of one silo location taking approximately one month. However, it will be necessary to verify this on a site-specific basis.

Because the silo locations are in attainment status areas for NAAQS for criteria pollutants and meteorological conditions are favorable to rapidly dissipate pollutants, the short-term impacts will likely be negligible. For those locations that are in close proximity to a Class I PSD area, the level of short-term impact will likely be low to moderate and will be verified at the next level of analysis.

#### 4.1.2.3 Potential Mitigation

Because avoiding an impact to the resource is not possible for the proposed action, mitigation measures could be implemented to reduce the significance of the impact.

Measures that could be implemented include periodic watering of the ground and restricting the travel speed on unpaved roads to reduce fugitive dust; ensuring that all construction equipment uses the best available control technology to reduce emissions; regulating the number of silos eliminated per day within each deployment area to reduce emissions; and limiting the activity to those times when the meteorological conditions favor rapid dissipation of pollutants.

## 4.1.3 HEAVY BOMBER STORAGE, CONVERSION, OR ELIMINATION FACILITIES

### 4.1.3.1 Analysis Methods

The analysis used to determine potential impacts at the bomber conversion or storage facilities is identical to the methods used at the deployment bases. (See Section 4.1.1.1)

### 4.1.3.2 Potential Impacts

Aircraft emissions are considered mobile sources of pollutants, thus, are not specifically regulated or permitted. However, these emissions - HC, CO, $NO_x$, $SO_2$, and PM, contribute to the overall levels of criteria pollutants within a given region or air basin. While aircraft emissions are presently exempt from permitting requirements, VOC emissions generated from painting aircraft are not.

The proposed action may increase the level of operations at the heavy bomber storage, conversion, or elimination facilities. This increase would result in a short-term adverse impact on the local air quality. The significance of the impact will depend on the number of aircraft arriving within any given time. Tinker, Kelly, and Davis-Monthan AFBs support flying missions; therefore, because of safety requirements and the logistics of scheduling flight operations, it is assumed that the additional arrivals of bombers will not cause a substantial increase in the number of operations per day. Based on this assumption, the potential impact to the resource would most likely be low or negligible. However, taking into account that Davis-Monthan and Tinker are in regions of non-attainment for the NAAQS, the significance of this impact could be greater. It will be necessary to verify this on a site-specific basis.

An increase in the conversion operations will have a potential temporary, adverse impact on the resource from the vapors generated by fuels, paints, solvents, lubricants, and other fluids while modifications are on-going. The level of significance of this potential, temporary impact will be dependent on the rate of increased operations, but must be analyzed at the specific locations. Once the specified modifications are complete, the level of operations at the conversion facilities will return to currently scheduled levels.

If aircraft are stored at Davis-Monthan AFB, baseline activity will increase, possibly requiring the construction of additional facilities to support the storage operations.

Emissions from construction activities will have a temporary, adverse impact to the air quality in the vicinity of the base.

#### 4.1.3.3 Potential Mitigation

Mitigation measures could be implemented to reduce the level of significance of the potential impacts. These measures could include scheduling the rate of aircraft arrival (and departure at the conversion facility) when flight activity is not at a peak; periodic watering of the ground during construction activities to reduce fugitive dust; and ensuring that all construction equipment uses the best available control technology to reduce emissions.

### 4.1.4 MISSILE STORAGE, CONVERSION, OR ELIMINATION FACILITIES

#### 4.1.4.1 Analysis Methods

The current state of technology for rocket motor elimination includes static firing and open detonation as the most common methods. In addition to static fire and open detonation, storage of rocket motors is a potential viable method of elimination under START but is not expected to significantly impact air quality. The analysis methodology for impacts to air quality from rocket motor elimination is based on a quantitative analysis of the impacts of static firing MM II rocket motors, and a qualitative comparison of other elimination methods relative to static firing.

Launch for commercial or research and development purposes, incineration of the propellant, firing of the motor in an enclosed chamber, scrubbing of a plume from static firing, and open detonation are other possible elimination methods that may adversely affect air quality. Other methods of taking missile motors out of service such as storage and washout would be conducted according to DOD and OSHA regulations. These two reduction methods would occur in a closed and controlled environment, would limit any potential for health and safety impacts to workers and the public, and are not analyzed further in this LEIS.

Several modeling scenarios were chosen to estimate the potential impacts to air quality from the elimination of ICBM and SLBM rocket motors. Modeling was conducted on the static firing of the first and third stages of the MM II under different climatic conditions. To assess the full range of impacts, the firing of MM II motors were modeled since Stage 1 represents one of the largest rocket motor stages, and Stage 3 contains a distinctly different fuel composition. Stage 3 propellant is primarily a nitrogen-based fuel while Stage 1 contains an AP-based propellant (see Table 2-1). A qualitative measure of the impacts of open detonation relative to static firing is presented in Section 4.1.4.2. A qualitative discussion of the relative impacts of static firing or open detonation of other rocket motors is also provided in this section.

The impacts to air quality were estimated by using two different air dispersion models. The Products-of-Combustion/Atmospheric Dispersion (PCAD) model was used to calculate emission concentrations. PCAD was developed specifically for the modeling of propellants, explosives, and pyrotechnics combustion, and the atmospheric dispersion of the combustion products. It provides information on the types of combustion products and their pattern of dispersion.

The Industrial Source Complex-Short Term (ISCST) model was also used to estimate ambient concentrations of pollutant emissions from static firing of MM II rocket motor (30, 32, 33). ISCST is an EPA-approved guideline model designed to evaluate air quality impacts from a wide variety of sources associated with an industrial source complex. The duration of the emissions from these two stages of the MM II was modeled as the equivalent of the designed burn time of the stages during static firing, 61 seconds for MM II Stage I and 57 seconds for MM II Stage 3 (1). The cloud produced by static firing was considered to be a volume source. The ISCST model was neither designed for emissions of such short durations nor for the types of sources involved in this study. Results from both modeling efforts are presented in Section 4.1.4.2 to illustrate the similar results between an EPA-approved model and one specifically designed for the modeling of rocket motor plume dispersal.

The meteorological data used as input to both models were determined by the limitations imposed by AMC-R 755-8, an Army regulation which restricts burning operations to certain specific wind speeds and directions. This Army regulation is applicable assuming burning activities could be conducted at current Army facilities which have experience with burning activities. This regulation limits burning operations to ground-level wind speeds between three and fifteen miles per hour (1.3 and 6.7 meters per second) and to those prevailing wind directions which would avoid carrying the plume to nearby public areas. Additionally, this regulation limits burning operations at various facilities to times when wind speeds and mixing heights combine to produce good dispersion conditions (24, 25). This, plus the wind speed restrictions, limits operations to periods when mixing heights are above 3,840 feet (1,170 meters) if the wind speed is fifteen miles per hour (6.7 meters per second), and above 19,190 feet (5,850 meters) if the wind speed is only three miles per hour (1.3 meters per second). Atmospheric stability classes were chosen for modeling purposes to be consistent with these wind speed conditions.

Atmospheric conditions have been classified into six stability classes, designated A through F (24). Class A represents the most unstable condition (most turbulent) and Class F represents the most stable. Stability Class B is slightly less turbulent than Class A, with slightly greater surface wind speeds. Stability Class C represents the conditions associated with partly cloudy skies and moderate winds. Stability Class D represents the neutral condition of atmospheric stability and characterizes overcast conditions. Average, high, and low wind values applicable to individual stability classes were used as input to the models to produce a range of possible concentrations of pollutants. Only four classes were analyzed (A, B, C, and D) because Classes E and F represent stable or inversion

conditions, which the current Army burning regulations are designed to avoid. In addition, Classes E and F represent conditions that are normally found at night when burning would not likely be done. Therefore, the modeled meteorological data were limited to eight cases defined by the above ranges of firing conditions. These values are presented in Table 4-1.

**Table 4-1**
**Input Parameters for Air Quality Models**

| Stability Class | Average Wind Speed** (m/s) | VPTG* (°C/m) | Air Density ($g/m^3$) |
|---|---|---|---|
| A | 7.0 | 0.00033 | 1060 |
| A | 2.0 | 0.001 | 1170 |
| B | 10.0 | 0.00033 | 1060 |
| B | 3.0 | 0.0033 | 1170 |
| C | 10.0 | 0.00033 | 1060 |
| C | 3.0 | 0.0033 | 1170 |
| D | 12.0 | 0.00033 | 1060 |
| D | 5.0 | 0.0033 | 1170 |

*Vertical Potential Temperature Gradient
**Wind speed applied to the plume. Ground-level winds typically are lower.

For the purposes of this evaluation, the same sets of meteorological conditions were used in the modeling of the two MM II stages. The meteorological conditions used for the models represent a realistic range in weather conditions. Site-specific terrain features at potential burn locations will not significantly affect the meteorological conditions and subsequent predicted values of emissions concentrations.

The plume modeling analyses predict ambient ground-level concentrations of emissions. These concentrations were compared with health criteria to determine the potential health impacts from burning rocket motors.

Criteria for CO and the major constituents of $NO_x$, NO, and $NO_2$, were derived from the NAAQS and National Institute for Occupational Safety and Health standards. No standards, with the exception of occupational standards, have been designated for acceptable levels of $Al_2O_3$ in ambient air. The ambient air standard for particulate matter of 260 $\mu g/m^3$, however, is an appropriate standard for $Al_2O_3$, an inert particulate.

There is no ambient air quality or other Federal standard for HCl. To evaluate the significance of the HCl expected to result from rocket motor combustion, a survey of available State and Federal standards and guidelines was conducted to identify the most appropriate ambient air quality standard. This survey also included reviewing

recommendations of various independent expert groups, particularly those of the National Research Council's Committee on Toxicology, and the American Conference of Governmental Industrial Hygienists (13, 2). This survey indicated that no Federal standards for HCl have been established; however, guideline values of 15 $\mu g/m^3$ (annual-average) and 150 $\mu g/m^3$ (three-minute average) have been proposed as part of EPA's municipal combustion regulations (31). Several states have also developed HCl guideline values. The most stringent of these is a maximum allowable concentration of 700 $\mu g/m^3$ based on a three- to five-minute averaging time (12).

Several non-governmental expert groups have developed HCl exposure limits. A Short-Term Public Limit of 6,000 $\mu g/m^3$ (4 ppm) has been recommended by the Committee on Toxicology of the National Research Council (13). This guideline is the maximum ten-minute average concentration in air to which the general public should be exposed. It is applicable to the assessment of rocket motor impacts because it was developed for protection of the general public rather than workers only, and it was specifically intended for exposure that occurs predictably, infrequently, and for a duration (ten minutes) that coincides closely with the duration of the two-minute combustion period of solid rocket motors (12). Short-term public limits for longer exposures were recommended at 3,000 $\mu g/m^3$ (2 ppm) for both thirty minutes and sixty minutes (13). Exposure within these limits is not considered to present any health hazards. The odor threshold for HCl is between 1,500 and 15,000 $\mu g/m^3$ (1-10 ppm). Concentration levels in the 7,500 - 15,000 $\mu g/m^3$ (5-10 ppm) range can produce strong odors and irritate the respiratory tract.

Exposure criteria could also be based on threshold limit values (TLVs). TLVs refer to airborne concentrations of substances and represent conditions under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effect (3). Fractions of the TLVs can be used to relate industrial exposure limits to non-industrial or public exposures. The rationale for doing this is that industrial exposures are for a forty-hour work week, with all members of the worker population assumed to be healthy adults. In a public health (non-industrial) setting, the population is assumed to be more diverse, ranging from children to senior citizens. Therefore, the criteria must be more stringent than those used in the industrial setting. The criterion for a one-hour exposure could be calculated by dividing the threshold limit value by ten. The TLV for HCL (7500 $\mu g/m^3$) is higher than the levels developed by the Committee on Toxicology of the National Research Council, but this factor divided by ten provides a conservative estimate to serve as a basis for evaluation of potential health effects. The rationale for doing this is to protect the most sensitive individuals (2). Similarly, additional longer exposure safety levels would be adjusted by a factor of ten to account for the uncertainty of the effects of long-term exposure. Thus, applicable occupational exposures or TLVs are divided by 100 to develop criteria for the 24-hour exposure. A criterion for annual exposures could be developed by dividing the threshold limit value by 1000. The combination of these fractions, which are suggested criteria for evaluating the air quality/health effects of the motor destruction operations, is presented in Table 4-2.

| Table 4-2<br>Suggested Criteria for Air Contaminants to Protect Health and Safety | | | |
|---|---|---|---|
| | Concentrations (ug/m$^3$) | | |
| | 1 Hour | 24 Hour | Annual |
| Aluminum Oxide | 1000[a] | 150[b] | 50[b] |
| Carbon Monoxide | 40000[b] | 10000[b] | 1000[b] |
| Hydrogen Chloride* | 750[a] | 750[a] | 750[a] |
| Nitrogen Oxide | 3000[a] | 300[c] | 30[d] |
| Nitrogen Dioxide | 1800[e] | 180[f] | 100[b] |
| Hydrogen Cyanide* | 1100[a] | 1100[a] | 1100[a] |
| Asbestos | [g] | [g] | [g] |

[a] Threshold Limit Value/10
[b] National Ambient Air Quality Standards
[c] Threshold Limit Value/100
[d] Threshold Limit Value/1000
[e] National Institute for Occupational Safety and Health
[f] National Institute for Occupational Safety and Health/10
[g] OSHA (29 CFR 1910.1001) sets a "permissible exposure limit" of 0.2 fibers/cm$^3$ (approximately 6 ug/m$^3$).
* The TLVs for these substances have a ceiling notation (:TLV-C") indicating a maximum exposure level based on acute effects. Thus, a single exposure level is used for all exposure periods.

### 4.1.4.2 Potential Impacts

#### 4.1.4.2.1 Static Fire

The air quality modeling calculated the maximum, one-hour average, and 24-hour average concentrations of major contaminants resulting from static firing of a MM II Stage 1 or 3. The one-hour average concentrations are those concentrations to which people could be theoretically exposed, if they stood still for one hour at one location while the plume passed them. For static firing, the plume could pass them in just a few minutes. Therefore, a one-hour average concentration is the average of a peak concentration for a few minutes, and the background level for the rest of the hour. With the exception of asbestos, none of the pollutants emitted from the rocket motors are known to be carcinogenic. The compounds HCl and NO are noted for their reactive and irritant properties. In high concentrations (greater than 10,000 μg/m$^3$), these compounds may cause lung damage. Carbon monoxide is known for its short-term asphyxiating properties and its ability to enhance the effects of chronic respiratory disease.

To keep the analysis conservative, the higher predictions from the PCAD model are used in subsequent sections to identify any potential impacts. The maximum concentrations

listed in the tables would be experienced over a very short time period of a few minutes because the nominal firing time of the MM II stages is approximately one minute. The lower concentrations that occur after plume spreading (depending on atmospheric stability class and distance downwind) will be experienced over a longer period of time, and will be directly dependent on wind speed. Because inversion conditions and very low wind speeds will be avoided, the plume is not expected to persist for more than an hour.

The combustion products calculated to result from the static firing of a MM II Stage 1 and Stage III are presented in Tables 4-3 and 4-4 respectively. The major exhaust components emitted from the nozzle are: aluminum oxide ($Al_2O_3$), hydrogen chloride (HCl), nitrogen ($N_2$), water ($H_2O$), carbon dioxide ($CO_2$), and CO. Small amounts of $NO_x$ may also be formed. In the presence of oxygen and at temperatures associated with static fire, very small quantities of CO are produced (24). With the exception of $Al_2O_3$, a particulate, all the major exhaust components are gasses. In water, HCl forms hydrochloric acid. The modeling results illustrating the two highest concentration levels for both stages from the eight model runs are shown in Tables 4-5 through 4-8. Data based on the entire set of modeling runs are presented in Appendix B.

The highest predicted concentrations occurred for modeling scenarios with relatively stable atmospheric conditions and low wind speeds. The predictions of the PCAD and ISCST models agree, within a factor of two, for the maximum concentrations, and the shape of the plume predicted by the two models agrees reasonably well. Figure 4-8 shows a contour graph of the concentration predictions from the PCAD and ISCST models for stability Class B with winds of three meters per second. (Note that the cross-wind scale is exaggerated in the plot from PCAD.) The downwind distance to the point of maximum concentration did not always agree with the two models; the largest deviation was for stability Class D, which did not show a maximum concentration within the twenty km area modeled in ISCST. The maximum ISCST prediction for Class D cases in Tables 4-6 and 4-8 refers to the maximum level within the modeled area.

A potential for short-term (less than ten minutes) human inhalation exposure to concentrations of combustion products of the rocket motors exists for both workers and the public. The emissions of concern from static firing include HCl, CO, $Al_2O_3$, and $NO_x$. Other combustion products would be nontoxic, would react rapidly to form nontoxic compounds, or would be emitted in insignificant quantities. Other potential emissions from open detonation, in which the casing is burned, include HCN and/or asbestos.

High concentrations (>10,000 $\mu g/m^3$) of metal dust can be an irritant to lungs and eyes. The toxicity of aluminum is very low. Aluminum has been found in high concentrations within blood serum and brain tissue of patients with Alzheimer's Disease. However, at the present time, insufficient evidence is available to determine whether aluminum is a causative agent or only a related factor (12).

**Table 4-3**
**Emissions Calculated by the PCAD Model for Minuteman II First Stage Static Firing (51,000 lbs. (23,200 kg) of Propellant)**

| Combustion Product | Emission Rate (g/sec) | Total Output (kg) |
|---|---|---|
| $Al_2O_3$ | 103,714 | 6,285 |
| CO | 1,810 | 110 |
| $CO_2$ | 134,960 | 8,179 |
| HCl | 60,643 | 3,675 |
| $H_2O$ | 93,083 | 5,641 |
| $N_2$ | 948,117 | 57,456 |
| NO | 13,525 | 820 |
| $O_2$ | 169,731 | 10,285 |

**Table 4-4**
**Emissions Calculated by the PCAD Model for Minuteman II Third Stage Static Firing (4,200 lbs. (1,900 kg) of Propellant)**

| Combustion Product | Emission Rage (g/sec) | Total Output (kg) |
|---|---|---|
| $Al_2O_3$ | 11,745 | 669 |
| CO | 456 | 26 |
| $CO_2$ | 15,639 | 891 |
| HCl | 1,410 | 80 |
| $H_2O$ | 5,956 | 339 |
| $N_2$ | 81,872 | 4,667 |
| NO | 1,444 | 82 |
| $O_2$ | 13,655 | 778 |

**Table 4-5**
**Model Results for Static Fire of Minuteman II Stage I Rocket Motor Under Stability Class C Conditions and 3.0 M/Sec Windspeed**

| | | PCAD Results | | ISCST Results | |
|---|---|---|---|---|---|
| Emission Products | Maximum Concentration ($ug/m^3$) | 1 Hour Average Concentration ($ug/m^3$) | 24 Hour Average Concentration ($ug/m^3$) | 1 Hour Average Concentration ($ug/m^3$) | 24 Hour Average Concentration ($ug/m^3$) |
| $AL_2O_3$ | 8,100 | 140 | 5.7 | 68 | 2.8 |
| CO | 141 | 2.3 | 0.1 | 1.2 | <0.1 |
| HCl | 4,700 | 80 | 3.3 | 40 | 1.7 |
| NO[a] | 1,100 | 18 | 0.7 | 8.9 | 0.4 |

Maximum concentration occurs at 9.2 km downwind

Plume height = 944 m

[a] NO is reported rather than $NO_x$ (equivalent to NO + $NO_2$) because the $NO_2$ concentrations are approximately 0.1% that of NO. This proportion is insignificant in comparison to the sensitivity of the computer models.

**Table 4-6**
**Model Results for Static Fire of Minuteman II Stage I Rocket Motor Under Stability Class D Conditions and 5.0 M/Sec Windspeed**

| | | PCAD Results | | ISCST Results | |
|---|---|---|---|---|---|
| Emission Products | Maximum Concentration ($ug/m^3$) | 1 Hour Average Concentration ($ug/m^3$) | 24 Hour Average Concentration ($ug/m^3$) | 1 Hour Average Concentration ($ug/m^3$) | 24 Hour Average Concentration ($ug/m^3$) |
| $AL_2O_3$ | 7,000 | 20 | 4.9 | 8.9 | 0.4 |
| CO | 122 | 2.1 | 0.7 | 0.2 | <0.1 |
| HCl | 4,100 | 69 | 2.9 | 5.2 | 0.2 |
| NO[a] | 920 | 15 | 0.6 | 1.2 | <0.1 |

Maximum concentration occurs at 12.2 km downwind

Plume height = 769 m

[a] NO is reported rather than $NO_x$ (equivalent to NO + $NO_2$) because the $NO_2$ concentrations are approximately 0.1% that of NO. This proportion is insignificant in comparison to the sensitivity of the computer models.

[b] Maximum concentration was beyond the range (20 km) of ISCST used to model this scenario.

**Table 4-7**
**Model Results for Static Fire of Minuteman II Stage 3 Rocket Motor Under Stability Class C Conditions and 3.0 M/Sec Windspeed**

| | | PCAD Results | | ISCST Results | |
|---|---|---|---|---|---|
| Emission Products | Maximum Concentration ($ug/m^3$) | 1 Hour Average Concentration ($ug/m^3$) | 24 Hour Average Concentration ($ug/m^3$) | 1 Hour Average Concentration ($ug/m^3$) | 24 Hour Average Concentration ($ug/m^3$) |
| $AL_2O_3$ | 4,100 | 65 | 2.7 | 40 | 1.8 |
| CO | 160 | 2.8 | 0.1 | 0.2 | 0.1 |
| HCl | 490 | 7.8 | 0.3 | 0.5 | 0.2 |
| NO[a] | 500 | 8.0 | 0.3 | 0.5 | 0.2 |

Maximum concentration occurs at 4.2 km downwind

Plume height = 429 m

[a] NO is reported rather than $NO_x$ (equivalent to NO + $NO_2$) because the $NO_2$ concentrations are *approximately 0.1% that of NO. This proportion is insignificant in comparison to the sensitivity of the* computer models.

**Table 4-8**
**Model Results for Static Fire of Minuteman II Stage 3 Rocket Motor Under Stability Class D Conditions and 5.0 M/Sec Windspeed**

| | | PCAD Results | | ISCST Results | |
|---|---|---|---|---|---|
| Emission Products | Maximum Concentration ($ug/m^3$) | 1 Hour Average Concentration ($ug/m^3$) | 24 Hour Average Concentration ($ug/m^3$) | 1 Hour Average Concentration ($ug/m^3$) | 24 Hour Average Concentration ($ug/m^3$) |
| $AL_2O_3$ | 3,600 | 56 | 2.4 | 0.9 | 0.4 |
| CO | 140 | 2.2 | 0.1 | 0.4 | <0.1 |
| HCl | 430 | 6.8 | 0.3 | 1.1 | <0.1 |
| NO[a] | 440 | 6.9 | 0.3 | 1.1 | <0.1 |

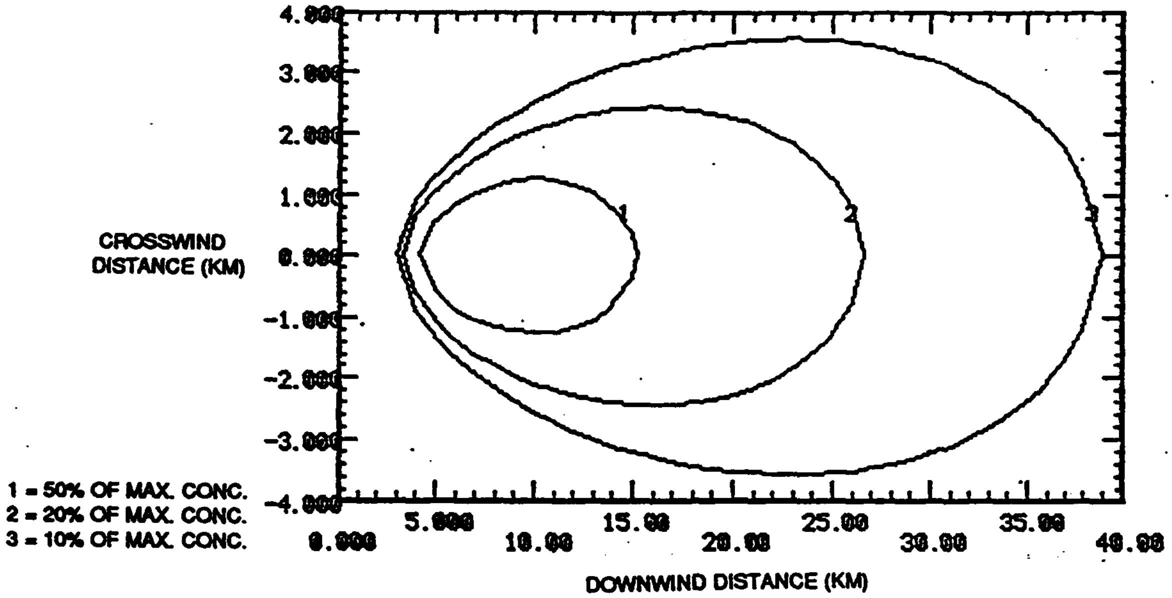
Maximum concentration occurs at 5.6 km downwind

Plume height = 769 m

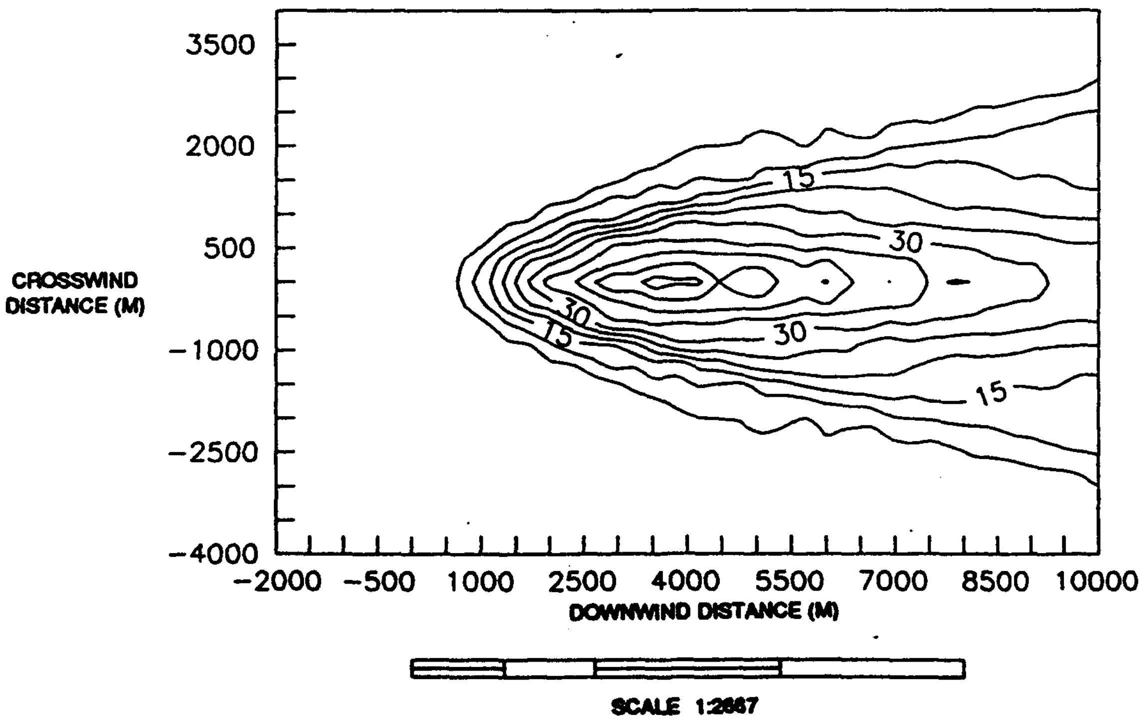
[a] NO is reported rather than $NO_x$ (equivalent to NO + $NO_2$) because the $NO_2$ concentrations are approximately 0.1% that of NO. This proportion is insignificant in comparison to the sensitivity of the computer models.

FIGURE 4-8
Contour Graphs of Plume Generated from Static Firing of Minuteman II Stage I Rocket Motor Under Class B Conditions with Wind Speed of 3.0 m/sec

PCAD




ISCST



The modeling results indicate that the predicted maximum concentration of $Al_2O_3$ would be about 8,000 $\mu g/m^3$, well below the level of concern for particulate irritants. The aluminum oxide that could be deposited in the environment from the elimination of solid rocket motors is a normally insoluble compound, which is only slightly soluble in diluted acids and alkali. The potential exposure of individuals to $Al_2O_3$ particulate matter is not likely to constitute a significant increase in their overall daily average intake of aluminum in various forms (many commonly consumed products, such as some antacids, contain aluminum as an ingredient or as a trace constituent).

$Al_2O_3$ is the only pollutant emitted which is covered by the PSD increment requirements. The atmospheric emissions from missile motor elimination, if this option is selected to implement provisions under the Treaty, may require that DOD obtain a PSD Permit. PSD regulations require a permit if emissions of particulate matter increase more than 250 tons per year for Class II areas (which apply to most areas of the country). Based on the $Al_2O_3$ particulate matter emissions, static firing or open detonation of 36 MM II Stage 1 rocket motors could exceed this PSD threshold, and a permit would be needed. However, operations could be conducted so that the $Al_2O_3$ emissions would not exceed the PSD increments shown in Table 4-9.

**Table 4-9**
**Prevention of Significant Deterioration (PSD) Increments for Particulate Matter**

| Concentrations (ug/m³) | | |
|---|---|---|
| **PSD Class** | **24-hour Averate** | **Annual Geometric Mean** |
| I | 10 | 5 |
| II | 37 | 19 |
| III | 75 | 37 |

The maximum 24-hour average $Al_2O_3$ concentration for firing one rocket motor per day was 5.7 $\mu g/m^3$ (predicted for the most adverse meteorological scenario modeled -- stability class C, windspeed 3 m/s). This level of $Al_2O_3$ is well below the PSD increment for Class II areas, and even below the more restrictive Class I increment that applies to National Parks, National Monuments, National Wilderness Areas, and other specially designated resources. The concentrations of $Al_2O_3$ modeled indicate that up to six MM II Stage 1 rocket motors could be fired in one day without exceeding the 24-hour average PSD increment for a Class II area. If it were assumed that six MM II Stage 1 motors were fired each day on half the days of a year, and that extreme-case meteorological conditions (including constant wind direction) prevailed for all operations, then the annual geometric mean could be 17 $\mu g/m^3$, slightly less than the annual geometric mean PSD increment for a Class II area. Class I areas closer than fifty miles [eighty kilometers

(km)] to any of the potential facilities could be adversely affected. The impacts at distances of greater than fifty miles (eighty km) are expected to be very small. Site-specific analysis and modeling would be needed to support PSD permitting for the individual elimination sites, and to ensure that no Class I areas within fifty miles of the operations would be affected.

Operations at missile motor elimination sites, including static firing or open detonation, could be restricted to certain favorable meteorological conditions and wind directions to minimize impacts of maximum plume concentrations to downwind receptors. With the exception of maximum concentrations which may only cause very brief exposures, all the anticipated levels of air contaminants are below the suggested health criteria presented in Table 4-2.

The concentrations of the four modeled pollutants emitted from MM II Stage 1 motors are higher than the concentrations emitted from a Stage 3 motor, with the exception of CO, which is negligibly lower. Thus, the overall impact of emissions from MM II Stage 3 motors are less than those from Stage 1 motors. The maximum one-hour average concentrations predicted from the plume modeling for CO (2.5 $\mu g/m^3$) and NO (18 $\mu g/m^3$) are well below the suggested criteria as shown in Table 4-10.

**Table 4-10**
**Suggested Criteria vs. Maximum Predicted Concentrations of Air Contaminants from Static Firing of a Minuteman II Stage 1 or Stage 3**

| | 1-Hour ($\mu/m^3$) | | 24-Hour ($\mu/m^3$) | |
|---|---|---|---|---|
| Emission Products | Suggested Criteria[1] | Maximum Predicted Concentration[2] | Suggested Criteria[1] | Maximum Predicted Concentration[2] |
| $Al_2O_3$ | 1,000 | 140 | 150 | 5.7 |
| CO | 40,000 | 2.5 | 10,000 | 0.1 |
| HCl | 750 | 80 | 750 | 3.3 |
| NO | 3,000 | 18 | 300 | 0.7 |
| Asbestos[3] | 6 | 0.4 | 6 | <0.1 |

[1]From data presented in Table 4-8

[2]From data presented in Tables 4-4 through 4-7

[3]Asbestos exposure is regulated by OSHA (20 CFR 1910.1001)

HCl levels predicted by the extreme static fire scenarios indicate that the maximum HCl concentration would be about 4,700 $\mu g/m^3$ (see Table 4-5). The one-hour average concentration of eighty $\mu g/m^3$ is well below the threshold limit value of 750 $\mu g/m^3$, with a ten-fold safety factor. Concentrations of $NO_2$ are approximately 0.1% that of NO. The one-hour maximum concentration of $NO_2$ (.018 $\mu g/m^3$) is far below the suggested one-hour criteria of 1800 $\mu g/m^3$ (see Table 4-2) Thus, $NO_2$ is not expected to have adverse impacts on human health and safety. Asbestos exposure is regulated by OSHA (29 CFR 1910.1001), which defines a "permissible exposure limit" for asbestos of 0.2 fibers per cubic centimeter. This equates to about 6 $\mu g/m^3$ (23). With the exception of the maximum concentration to which a person might be exposed for only a few minutes, the predicted worst-case levels of asbestos are well below the permissible exposure limit for occupational exposure. Because asbestos does not cause acute toxicity, it is appropriate to compare the average concentrations below one hour or 24 hours with the permissible exposure limit.

Asbestos is in the nozzles, the casing liner, and in several other components of the MM II motors (38). Data on how much asbestos could be released during static firing were not available. For the MM II Stage 1 motor, it was assumed that ten percent of the asbestos in the nozzle and liner could be emitted, along with all of the other asbestos in the stage, for a total emission of about 20 kg. The maximum resulting ground level concentration of asbestos was estimated from the modeling runs. The potential concentration of asbestos emitted from static firing of the MM II Stage 1 motor can be approximated by applying the ratio of the estimated amount of asbestos entrained in the plume (20 kg), and the amount of HCl emitted (3,675 kg from Table 4-3), to the concentration of HCl modeled by PCAD. Under the extreme case meteorological conditions that were modeled (Stability Class C, 3 m/s windspeed), the anticipated concentrations of asbestos could be as follows: maximum concentration - 25.6 $\mu g/m^3$, one-hour average - 0.44 $\mu g/m^3$, and 24-hour average - 0.02 $\mu g/m^3$. The potential cumulative effect of asbestos emissions is addressed in Section 4.11.9.

The impacts of static firing MM III and Peacekeeper rocket motors would be similar to those impacts discussed for MM II Stage 1. Nitrogen-based sections such as the MM III Post Boost Control System and Peacekeeper SCDM have lower proportions of aluminum and AP than AP rocket motors; thus, they emit lower proportions of $Al_2O_3$ and HCl. While the quantity of NO produced may be greater in Nitrogen-based motors, the amounts will still be relatively small and are not expected to approach the suggested criteria levels listed in Table 4-2.

Stage 1 of the Peacekeeper is the largest ballistic missile rocket motor and is approximately twice as large as the MM II Stage 1 (See Table 2-1). The total emissions from firing a Peacekeeper Stage 1 may be conservatively estimated at roughly twice MM II Stage 1. The concentration of emissions from firing a Peacekeeper Stage 1 is projected to be well below the one-hour average concentrations for $Al_2O_3$, CO, HCl, and NO (see Table 4-5 and 4-6.). Emissions from MM III rocket motors will be less than

Peacekeeper, and comparable to MM II Stage 1. Thus, the emissions from MMIII rocket motors are projected to be less than the health standards.

Implementation of the static fire method may not occur without satisfying certain regulatory criteria and obtaining the necessary environmental permits. Elimination of Pershing rocket motor pursuant to the INF at Pueblo Army Depot Activity and Longhorn Army Ammunition Plant required State air permits and State authorization.

#### 4.1.4.2.2 Open Detonation

Open detonation of rocket motors would create a plume that could exist longer, but have lower concentrations of emissions than from static firing of the motors. Because the estimated emission concentrations from static firing were well below the health-based standards, and the concentrations from open detonation are even lower, no significant adverse impacts are projected for open detonation of rocket motors, pending further study of asbestos and HCN emissions.

Open Detonation of one MM II Stage 1 rocket motor lasts from two to four minutes, and for a MM II stage 3, takes approximately two minutes (5). The plume of emissions from open detonation is slightly different from that of a static fire. The same amount of propellant burns longer (several minutes) during an open detonation. This, plus the larger surface area producing emissions (the entire length of the ruptured case), will result in a cloud that is initially less dense and more dispersed than a static fire cloud. When the lower edge of this cloud reaches the ground, it will already have a lower concentration of emissions than in the static fire method. Thus, the maximum ground level concentration of emissions experienced from open detonation will be lower, but will last longer because the more dispersed cloud will take longer to pass a given spot. The chemicals emitted from the two modes will be largely the same, except for some potential minor differences in the proportions of NO and CO due to different degrees of $O_2$ becoming entrained in the plume which allows for afterburning of CO to $CO_2$ and NO to $NO_2$ just out of the nozzle.

There are two additional pollutants from open detonation, asbestos and hydrogen cyanide (HCN), that could occur in some instances. A MM II Stage 1 rocket motor contains 84 pounds of asbestos, not all of which could be removed prior to an open burn. A portion of the remaining amount of asbestos-containing material might become entrained in the plume. Also, HCN is a possible combustion product of the Kevlar™ motor casing of Peacekeeper motors. The composition of the motor casings and its potential contribution to the plume during open detonation will have to be assessed before any elimination of rocket motors by this method.

Some states have air quality regulations that limit emissions opacity, opacity being the ability of light to pass through the atmosphere. For example, the Utah State Bureau of Air Quality, Rule 446-1-4, limits the emissions opacity to twenty percent. The opacity of the plume formed from the static fire test of a Pershing II missile exceeded the opacity

stipulated in the rule. Part II, Section 2.3 of the rule permitted the Army to submit a petition for variance because no practical or available control technology to minimize the plume generated by the firing existed (26). Pending selection of the potential location and method of elimination, applicable state permit requirements regarding air quality should be fulfilled early in the process to prevent constraints on the established time-frame of events.

The impacts of open burning MM III and Peacekeeper rocket motors would be similar to the impacts discussed for MM II Stage 1. The relative difference in emission products is similar to that described for static firing these rocket motors.

#### 4.1.4.2.3 Other Methods

Assuming that incineration, enclosed firing, and scrubbing are conducted under proper conditions with adequate equipment and resources, the impacts to air quality may be less than from static firing and open detonation. Static firing with plume scrubbing has been demonstrated to reduce emissions at pilot scale level. This process generates high volumes of contaminated water and also decreases the afterburning of CO to $CO_2$ and $H_2$ to $H_2O$ (5). Scrubbing of the plume can be conducted in an enclosed chamber designed to hold a rocket motor (28) or at outdoor static firing ranges. Pilot facilities designed to conduct indoor tests on rocket motors at the Arnold Engineering Development Center in Tennessee, and at the Air Force Rocket and Propulsion Laboratory, Edwards Air Force Base, California, have demonstrated high efficiencies in scrubbing HCL and $Cl_2$ from exhaust plumes. The use of similarly designed facilities for the elimination of rocket motors would result in negligible impacts to the outdoor air quality. Plume scrubbing of rocket motor exhaust in the open atmosphere will have to utilize sufficient water to prevent the formation of an acid rain cloud, or the resulting impacts to vegetation, biota, surface water quality, and human health could be highly adverse.

Incinerators must be designed to achieve a destruction and removal efficiency of 99.99 percent for principal organic hazardous constituents, such as nitroglycerin, $NO_x$, and HCN (40 CFR 261, Appendix VIII). Also, requirements to control particulates and HCl emissions will effectively limit any possibility of adverse impacts to air quality. Incineration facilities must also obtain a RCRA permit prior to operation.

Storage of missiles will require long-term caretaker activities that may increase emissions, but due to the location of the storage facilities no significant impact to air quality is expected from the construction and operation of such facilities.

Launching of the rocket motors as a means of elimination would create emissions similar to those produced for static firing, but the ground level concentrations of emissions would be lower. Dispersal of the emissions would occur over a larger area because the source is moving and emissions travel further at higher altitudes (20).

Construction of new facilities, including the PPCM facilities, and equipment may be required for facilities to implement the various elimination options. This construction activity would adversely impact air quality due to increased construction-related emissions. Subsequent operational activity would also adversely impact air quality, primarily from increased stationary source emissions.

Almost any air pollutant-emitting modification or new facility will require a permit under the Clean Air Act. Incinerators that burn rocket motor propellant and facilities where static firing or open detonation of rocket motors are being contemplated will need air quality permits. The siting, construction, and operation of an activity or facility can be greatly influenced by permit requirements.

#### 4.1.4.3 Potential Mitigation

The Federal, state, local, or agency regulatory arena in which the potential methods of elimination could occur provides a structured avenue of mitigation. The principal advantages that incineration offers over the other potential elimination methods are that emission control devices can be installed which will mitigate the health and environmental concerns posed by static firing or open burning. Scrubbing of a static fire plume, if conducted with an adequate amount of water or in an enclosed facility, would also serve as a mitigation measure.

Site-specific factors to mitigate air pollutant emissions and impacts will be analyzed fully prior to the commencement of any rocket motor firing or burning associated with reducing the number of non-deployed rocket motors. The rocket motor nozzles could be removed prior to any burning activities to reduce the potential for asbestos becoming entrained in the plume. Plume scrubbing, whether conducted at incinerators or outdoor burning locations, could decrease the emissions from rocket motor burning and, consequently, cause fewer, less adverse impacts than static firing or open detonation. Another potential mitigation measure could be to conduct open detonation or firing at several locations to minimize the cumulative impacts at any particular site.

The elimination techniques with the most potential to impact the public could be dependent on weather conditions to minimize the concentrations of pollutants to downwind receptors and the frequency of rocket motor firing and burning. Wind direction limitations could be designated for individual sites to avoid any public areas nearby. No rocket firing and burning would occur if public facilities are one mile downwind. The time of day for firing or burning could be limited to the period from one half hour before sunrise to one half hour after sunset.

Other elimination methods for rocket motors, such as incineration and washout, could be done inside facilities, minimizing emissions and exposure of the public to hazardous materials. Firing of a rocket motor in an enclosed chamber and plume scrubbing are two techniques that may also mitigate effects of rocket motor firing or burning on human

health. Storage of rocket motors, both short- and long-term, would be in climate-controlled structures, separated according to quantity-distance requirements to minimize any possibility of propagation of propellant fire or detonation in a storage area.

## 4.2 NOISE

It is a national policy to promote an environment free from noise that jeopardizes public health or welfare. The effects of noise are related to the magnitude of the noise levels generated by the activity and the existence of noise-sensitive receptors nearby. The distance between a noise source and a noise receptor is a major factor in determining the amount of attenuation (the absorption, diffraction, or reflection of noise by the atmosphere, land forms, or objects) and subsequent degree of impact. Noise levels are attenuated a minimum of six dB per doubling of distance from a source due to divergence alone. Atmospheric absorption and ground features provide attenuation, particularly of the higher frequency sounds at distances of several miles. Typically, only the low frequency components of sounds would be heard at large distances.

The degree of impact is also influenced by the receptors' familiarity with, and attitude towards, the noise source; the time of day the noise occurs; physiological and behavioral effects such as hearing loss and sleep interference; and subjective effects such as annoyance.

Potential Treaty-generated activities will generate different types of noise at the various facilities. Possible noise levels and subsequent potential impacts of concern are those that could be generated by aircraft operations, elimination of launchers, rocket motor elimination, and construction activities. Different criteria are used to determine the significance of impacts on noise-sensitive receptors for these activities at various deployment and elimination facilities.

The EPA has identified a criterion of $L_{dn}$ = 55 dBA as being adequate to protect against activity interference in outdoor residential spaces and other spaces where quiet is a basis for use (35). The DOD has adopted this level as a goal, but not a standard, for exterior noise levels.

There are two approaches DOD uses to assess the annoyance of demolition noise to the community. These approaches would be applicable to silo destruction activity at the ICBM deployment bases and to static firing or open detonation of missile motors at potential elimination sites. One approach, based on an American National Standards Institute methodology, averages the cumulative energy from all of the explosions over a 24-hour period. This method is known as the C-weighted day-night level (CDNL). With CDNL, the blasts are measured using a scale of the sound level meter which emphasizes low frequencies (C-scale) rather than audible frequencies (A-scale). The CDNL methodology is most appropriate for communities exposed to approximately the same daily or weekly noise environment over a period of years.

An alternate approach, which addresses the potential for community complaints from a specific operation, is based on the complaint management program at the Naval Surface Weapons Center, Dahlgren, Virginia. The criteria used at the Center for determining

whether a particular operation is likely to generate complaints are presented below. The entries represent the linear peak decibel levels of individual blasts, as they would be measured at the home of the complainant.

| dB (peak) of Highest Single Blast | Risk of Noise Complaints |
|---|---|
| 0-115 | Low risk of noise complaints. |
| 115-130 | Moderate risk of noise complaints. |
| 130-140 | High risk of noise complaints. Possibility of damage claims. |
| above 140 | Threshold for permanent physiological damage to unprotected human ears. High risk of physiological and structural damage claims. |

An increase of 10 dBA over the ambient noise level of aircraft operations could be considered significant; exposure to greater than 75 $L_{dn}$ or exceeding OSHA health limits during rocket motor elimination activities could be significant. Impacts could be low if ambient noise levels increased by less than 5 dBA, or for exposures between 55 and 65 $L_{dn}$. A decrease in the ambient noise level is viewed as a beneficial impact.

The frequency of occurrence of major noise-generating activities may increase during the specified time frame of the Treaty and then possibly return to current baseline activity levels after Treaty requirements are met.

### 4.2.1 HEAVY BOMBER DEPLOYMENT BASES

#### 4.2.1.1 Analysis Methods

To determine potential impacts attributed to noise, the method used for this level of analysis centered on a review of available data, documents, and publications. The review covered, but not exclusively, NEPA documents on force structure changes, base comprehensive plans, AICUZ reports, and applicable Federal legislation and regulations. Particular attention was given to the existing force structure at the bases, adjacent land use, proximity of noise-sensitive receptors, and any record of noise complaints.

Identification of actual noise impacts will occur at the site-specific level of analysis. This will involve collecting and analyzing data on flying operations, generating noise contours using the NOISEMAP computer program, specific identification of noise-sensitive receptors and land use, and defining local attitudes.

#### 4.2.1.2 Potential Impacts

Aircraft are the primary contributors to the noise environment in and around the base, with the majority of the flying operations being training-related. Exposure to noise is measured on a series of aircraft operations over the day with the greatest exposure in the vicinity of the runway. The proposed action, resulting in a withdrawal of aircraft from a base, will result in a long-term beneficial impact on the noise environment.

The significance of the impact will depend on the number of aircraft that could be removed from any given location and the resulting decrease in flying activity. If planes were to be removed from a base that supports other types of aircraft or flying missions, the level of impact — although beneficial — will be low, assuming that the other aircraft or missions are the primary contributors to the existing noise environment. For those locations adjacent to metropolitan areas, the beneficial impact from removing aircraft will, again, be low because the existing noise environment is not entirely dictated by AF operations. However, the level of significance is dependent on the number of aircraft involved and will be verified on a site-specific basis.

#### 4.2.1.3 Potential Mitigation

The impacts resulting from the proposed action are expected to be beneficial in nature, and thus no potential mitigation is anticipated.

### 4.2.2 ICBM DEPLOYMENT BASES

#### 4.2.2.1 Analysis Methods

The analysis to determine potential impacts on the noise environment at the ICBM deployment bases was similar to the analysis used at the heavy bomber deployment bases. See Section 4.2.1.1. Additional analysis for this section included a data review on noise generated by construction equipment, vehicles, and explosives.

Identification of actual impacts on the noise environment will occur during the next level of analysis. Similar to what appears in Section 4.2.1.1, analysis methods will also include utilizing a single-point-source noise model and reviewing data on noise emissions from construction equipment and explosives.

#### 4.2.2.2 Potential Impacts

Activity could increase around the launch facilities during the elimination and restoration of the silo site. The explosive blasts, along with additional vehicular traffic, heavy equipment, and construction activities will all have a short-term impact on the ambient noise levels. The significance of this impact will be dependent upon the magnitude of the elimination activity and the length of time necessary to complete the proposed action.

The blasting activities will result in high single, instantaneous noise levels. Sounds of this type contain most of their acoustic energy in the lowest frequencies of the auditory spectrum and are usually not considered offensive because the human ear is relatively insensitive to low frequencies. Similarly, wildlife usually ignores sounds of this type since they resemble thunder and would pose no definable threat. The significance of this impact on the noise environment will depend on the duration of the blasting activities and the proximity of noise-sensitive receptors. The impact will depend on the distance, terrain, and atmosphere between the blast source and receptor. The greater the distance and the variation in ground features and atmospheric conditions, the greater the attenuation could be, reducing the significance of the impact. However, this will need to be verified and the significance determined at the next level of analysis.

The low frequency sound emitted from the blast could also impact physical structures in the vicinity of the silos. This could include rattling windows and vibrating walls in wood frame buildings.

Vehicles and construction equipment will have a short-term impact on the noise environment. Again, the significance of this impact will be determined by the magnitude and duration of the elimination activity. Based on a review of estimated noise emissions during a construction project, this adverse impact will likely be considered low, but will need to be verified on a site-specific basis.

#### 4.2.2.3 Potential Mitigation

Because complete avoidance of this impact is not possible, mitigation measures could be implemented to reduce the significance of the impact. These measures could include restricting the activities to daylight hours, limiting the amount of blasting activity during critical seasons for wildlife, considering meteorological/atmospheric conditions for attenuation, and ensuring that construction equipment has mufflers.

### 4.2.3 HEAVY BOMBER STORAGE, CONVERSION, OR ELIMINATION FACILITIES

#### 4.2.3.1 Analysis Methods

The analysis to determine potential impacts on the noise environment at the storage, conversion, or elimination facilities was identical to the analysis used at the heavy bomber deployment bases. See Section 4.2.1.1. Additional analysis for this section included a data review on estimated noise emissions from construction equipment and vehicles.

Identification of actual impacts on the noise environment will occur during the next level of analysis. Analysis methods will also include using a single-point-source noise model to determine noise generated by construction equipment.

#### 4.2.3.2 Potential Impacts

Aircraft and industrial operations are the primary contributors to the noise environment around the bomber storage, conversion, or elimination facilities. The proposed action—the arrival of aircraft; storage, conversion, or elimination operations; and the ultimate departure of aircraft from Tinker and Kelly AFBs—will result in a short-term adverse impact on the noise environment.

The significance of the impact will depend on the number of aircraft that could arrive at either facility within any given time and the level of conversion or storage activities taking place. All three facilities support flying missions; therefore, due to safety requirements and the logistics of scheduling flight operations, it is assumed that the additional rate of arrival for the bombers will not cause the current number of daily operations to be greatly exceeded. Based on this assumption, the potential impact to the noise environment from additional aircraft will likely be low or negligible.

Increased conversion and storage will also have a potential adverse impact on the noise environment from the increased operation of the equipment or machinery used during these activities. The level of significance of these potential impacts will be dependent on the rate of increased operations and the proximity to noise-sensitive receptors, but must be analyzed at the specific locations.

If the storage option is exercised, a long-term, minor increase in noise might be experienced because of caretaker activities associated with the increase in stored assets at the facility. If additional storage facilities are required, short-term, adverse noise emissions from the construction activities will result. Conversely, lower activity might be expected at Tinker and Kelly AFBs because of the possibility for fewer assets requiring periodic maintenance. Also, if the conversion option is exercised, no increased activity will be expected at Davis-Monthan AFB, while increased activity will be expected at the other two facilities during the conversion period. A mixture of the two options will result in impacts greater than the baseline activities, but less than impacts associated with one option or the other.

#### 4.2.3.3 Potential Mitigation

Mitigation measures could be implemented to reduce the level of significance of the potential impacts. These measures could include scheduling the rate of aircraft arrival (and departure at the conversion facility) when flight activity is not at a peak; limiting conversion or storage operations to daylight hours; and ensuring that all construction equipment has mufflers.

## 4.2.4 MISSILE STORAGE, CONVERSION, OR ELIMINATION FACILITIES

### 4.2.4.1 Analysis Methods

The following discussion of noise impacts at missile storage, conversion, or elimination facilities primarily focuses on the impacts from static firing and open detonation of rocket motors. Storage, washout, and incineration of missiles may require construction of facilities, resulting in a temporary increase in noise levels. If the missiles are stored, long-term caretaker activities will increase noise levels, but due to the location of these facilities no impact is expected.

To determine potential impacts attributed to noise at the elimination facilities, the method used for this level of analysis centered on review of available data, documents, and publications including NEPA documents specifically addressing the noise generated from the static firing and open detonation of rocket motors. Potential noise impacts have been evaluated based on quantitative noise measurements from previous static firing and open detonation activities.

Identification of actual noise impacts would occur at the site-specific level of analysis. This would involve test monitoring of noise levels generated by the static firing or open detonation of rocket motors removed from deployed status as a result of the Treaty. Identification of the location of noise sensitive receptors surrounding the elimination facility would also be necessary. Additionally, the distance between the noise source and a noise receptor, attenuation factors, and atmospheric conditions would need to be determined.

The potential elimination methods, static fire and open detonation, produce different types of noise which must be evaluated using different criteria. Static firing produces a loud, constant noise level over a period of about one minute. The period of firing for different rocket motor stages is similar due to their design. Open detonation produces a sharp initial noise, followed by a much lower and inconsequential noise level over a several minute burn period (possibly longer depending on the burn configuration).

Applicable criteria do not exist which specify acceptable levels of short duration noises. Several states have regulations which limit continuous noise levels at residential property lines, but even those criteria are not totally applicable because they include long-term or long duration sources of noise. Presumably, higher levels could be considered acceptable if the durations were shortened.

Because no single noise descriptor adequately describes the expected scenario, both instantaneous and $L_{dn}$ descriptors will be used to determine a range of noise levels where impacts could occur. Under elimination of the Pershing missiles, instantaneous and day-night levels were predicted for distances ranging from one to five miles from the site, for a total of six rocket engines fired during daylight hours, and none fired at night on a given

day. A similar process could be conducted prior to any static firing of rocket motors, as required by the Treaty. Any noise-generating activities will be monitored at the missile motor elimination sites.

### 4.2.4.2 Potential Impacts

#### 4.2.4.2.1 Static Firing or Open Detonation

Static firing of rocket motors removed from deployed status would adversely impact the noise environment surrounding the rocket motor elimination facilities. The proximity of noise receptors and attenuation factors will determine the severity of the potential impacts. Elimination of rocket motors smaller than the currently deployed ICBM motors has been taking place at the elimination sites on a routine basis for up to thirty years. Elimination of solid rocket motors by static firing or open detonation does not represent the introduction of an unknown or unfamiliar source of noise into the existing environment of current elimination facilities. However, elimination of the larger motors such as the MM II Stage I motor, would increase noise levels at these facilities.

The static firing of Pershing rocket motors achieved a goal level of 55 dBA at a distance of 1.5 miles (2.4 km) from the elimination sites (23). The instantaneous noise level at this distance would be about 79 dBA, which is similar in magnitude to heavy city traffic. Static firing of rocket motors larger than the Pershing will create higher noise levels further from an elimination site. For example, launch noise for the Titan III C, Saturn V, and Space Shuttle rocket boosters at a distance of approximately 10 km from the launch site had a maximum of about 90 dBA (12).

Measurements made during an actual launch of a MM missile indicated that the overall sound pressure level at a distance of 1.8 miles (2.9 km) was 122 dB (18). A frequency spectrum was not obtained, but, for purposes of noise level projections, it has been assumed that the noise is broadband with no dominant tonal component. A study of Pershing II rocket motor noise during a static fire test at Redstone Arsenal confirmed measurements made during actual launch of the missile (23). This correlation supports a similar static fire noise pattern for the MM II Stage I, as measured during an actual launch. Based on the Naval Surface Weapons Center noise criteria, a moderate risk of noise complaints can be expected if any receptors are within 1.8 miles of the firing site.

Open detonation of rocket motors will also impose potential adverse impacts on the noise environment, but the severity of the potential impacts will likely be less than impacts from static firing because of characteristics of the sound generated. The dominant sound in the elimination of the rocket motor by open detonation is not the rocket motor, but the high explosive (about 10-20 pounds) used to initiate the burn. For static firing, the rocket motor generates the noise. Sounds from explosives contain most of their acoustic energy in the lowest frequencies of the auditory spectrum. Because low frequencies are less likely to be attenuated by the atmosphere, vegetation, or terrain than high frequencies,

the low frequency sound from demolitions can be measurable at distances far from the explosion. Auditorially, such low frequency sound is not usually offensive, since the human ear is relatively insensitive to low frequency. Similarly, wild animals ignore the sound, since it resembles thunder and poses no definable threat to their territory. Problems can arise, however, when the low frequency energy interacts with a wood frame structure, causing window rattles and wall vibrations.

Current Air Force safety regulations require that no unprotected personnel be within about two miles of an open detonation or static fire of a rocket motor of the MM class or larger. This distance is sufficient to preclude a hearing hazard. Noise levels from a static fire are directional and quite large, and the potential for community annoyance is of concern.

#### 4.2.4.2.2 Other Methods

Noise levels associated with construction of any required facilities, including storage facilities, will depend on the level of construction and will be addressed in greater detail in site-specific analyses.

Assuming incineration, enclosed firing, and scrubbing are conducted under proper conditions with adequate attenuation, and in accordance with OSHA regulations, noise impacts from these methods may be less than from static firing or open detonation.

### 4.2.4.3 Potential Mitigation

DOD could conduct all of the noise-producing activities during daylight hours. Thus, there would be no potential for sleep disturbance or other nighttime impacts. Operational constraints which would prohibit operations during temperature inversions could be used at elimination sites.

The frequency of open detonation activity could be similar to the schedule for the static method of elimination. Open detonation will also likely take place during daylight hours. As in the case of the static fire method, mitigations among sites for noise impacts can be directly related to the number of receptors located near the sites.

## 4.3 WATER RESOURCES

Water resources are limited and renewable resources whose quality is easily degraded by physical or chemical disturbances.

The criteria used to determine the significance of impacts on water resources include the EPA maximum contaminant level (MCL) and various Federal and state water quality and water usage regulations. Impacts will be significant if the MCL is exceeded, new supply facilities must be constructed, or average yearly withdrawal is expected to increase and exceed the average yearly net recharge rate. Moderate- to low-level impacts can be expected if portions of the resource are affected, or the value of the resource in that particular area is not important. Beneficial impacts will occur if the resource is increased or upgraded in quality by the proposed action.

### 4.3.1 HEAVY BOMBER DEPLOYMENT BASES

#### 4.3.1.1 Analysis Methods

The analysis to determine potential impacts on the water resources was based on a literature review of secondary documents for all potentially affected locations. The review covered, but not inclusively, NEPA documents for force structure changes, base comprehensive plans, documents for base realignments and closures, and the IRP documents. Particular attention was given to the water supply source and quantity and to water quality.

#### 4.3.1.2 Potential Impacts

The proposed action is not expected to have potential adverse impacts to the surface water or ground water quality because the action is a reduction of current operations at the deployment bases. Any reduction in aircraft maintenance activities will result in a beneficial impact to the water supply. The significance of this impact will depend on the number of aircraft removed from any given base, the reduction in water usage, and the potential for contamination. This potential impact will need to be confirmed on a site-specific basis.

#### 4.3.1.3 Potential Mitigation

The impacts resulting from the proposed action are expected to be beneficial in nature, and thus no potential mitigation is anticipated.

## 4.3.2 ICBM DEPLOYMENT BASES

### 4.3.2.1 Analysis Methods

The analysis was based on a literature review of existing data and publications for all potentially affected locations. The review centered on the locations' water quality, types of water supplies, and water usage. The bases and the overall water quality in the region were noted, along with any aquifers or water bodies that are of importance, and the proximity to and use of these resources by the bases. Particular emphasis was given to existing water resources to define those areas where water supplies may potentially be affected.

Identification of actual impacts on water resources will occur at the site-specific level of analysis. Resource identification will involve interviews with knowledgeable personnel, water survey reviews, and on-site field surveys.

### 4.3.2.2 Potential Impacts

The explosive demolition of the missile silos could cause impacts on the water resources. The local or regional aquifers could become slightly compacted from shock waves and pressure changes, temporarily or permanently changing the aquifer's permeability or effective porosity. (See Section 4.4.2.)

Potential impacts on surface water quality and hydrology could occur during silo elimination since storm water runoff would wash away some disturbed soils. An event such as a rainstorm will have a significant short-term impact on stream sediment load in an area of soil disruption resulting in altered water quality. Potential surface water impacts could include an alteration of the local hydrology due to erosion or sedimentation derived from project-related disruptions of the soil.

### 4.3.2.3 Potential Mitigation

The area of impact on the aquifer could be lessened by selectively placing less powerful explosives in the structurally weakest locations of the silos. To avoid impacts to the subsurface water, a site-specific geological study could be conducted to determine the amount of damage that blasting may do to certain types of aquifers. Silt screens, drainage collection canals, and ponds could be built to reduce the potential impact on surface water quality.

There are underground storage tanks (USTs) containing fuel at all ICBM deployment sites. Closure of the sites will require compliance with Subtitle I of RCRA. Compliance will lessen the potential for groundwater contamination due to possible leaks or spills associated with the USTs. The time frame required for compliance is dependent on the

extent of potential soil and groundwater contamination, and any necessary steps for remediation.

### 4.3.3 HEAVY BOMBER STORAGE, CONVERSION, OR ELIMINATION FACILITIES

#### 4.3.3.1 Analysis Methods

The analysis methods used to determine potential impacts at the heavy bomber storage, conversion, or elimination facilities are similar to the methods used at the ICBM deployment bases. See Section 4.3.2.1 for this discussion.

#### 4.3.3.2 Potential Impacts

The potential increase in the generation, disposal, and storage of hazardous wastes due to increased activity associated with bomber storage, conversion, or elimination may cause an increase in contaminated runoff beyond the capacity of the oil/water separators. Surface and ground water would be degraded if excess untreated water enters these water bodies. As part of the conversion at Tinker and Kelly AFBs, quantities of industrial wastewater may increase. Therefore, in addition to the oil/water separators, industrial waste treatment plants may have to be replaced or upgraded.

The significance of the impact will depend on the number of aircraft involved. Routine ground disturbance and the potential for periodic flooding in the desert valleys will allow contaminated debris to be washed out of the bomber storage area or defueling pad of the storage site. Because of low annual rainfall, surface water degradation will be infrequent in the vicinity of Davis-Monthan AFB. Little potential exists for solvents, fuels, or hydraulic fluids leaching into the ground water due to the precautions taken by the AF, as well as the considerable depth to the water table. The proposed action is not expected to stress current water supplies.

#### 4.3.3.3 Potential Mitigation

Any potential adverse impacts to the water resources will require mitigation to reduce pollution to insignificant levels. This could include developing site plans by qualified civil engineers to utilize storm water management practices; restricting site grading activities during the rainy season; and replacing or upgrading the oil/water separator treatment processes.

## 4.3.4 MISSILE STORAGE, CONVERSION, OR ELIMINATION FACILITIES

### 4.3.4.1 Analysis Methods

The analysis methods used to determine potential impacts at the missile storage, conversion, or elimination facilities are similar to the methods used at the missile deployment bases. See Section 4.3.2.1 for this discussion.

### 4.3.4.2 Potential Impacts

#### 4.3.4.2.1 Static Firing or Open Detonation

Static firing would result in impacts to both ground and surface waters from plume deposition. The pollutants of concern include exhausted HCL and $Al_2O_3$. The pH of surface water could be lowered by HCL, and the aluminum oxide concentration would likely be raised. Consequently, the surface water might then contaminate ground water (12). The magnitude of the impact would be dependent on the amount of dispersion prior to deposition and the buffering capacity of surface waters. The quantity of bicarbonate present in the water determines the ability to maintain current pH levels. Given that the deposited aluminum is primarily in the oxide form, its behavior would parallel a natural mineral system and may not necessarily result in significantly elevated levels of dissolved, free aluminum in the surface waterbody (12). A monitoring program could effectively determine total and soluable aluminum and pH.

Open detonation would have similar impacts to water resources as those identified for static firing. During open detonation, it is possible for other trace contaminants to be formed due to incomplete combustion with some of these contaminants remaining in the burn pit. For example, burning of the Peacekeeper and Trident (C4) Kevlar™ casings may form very small quantities of HCN. Open detonation also results in the explosive scattering of firebrands. Because of this scattering of firebrands, the potential trace products described above would be deposited on the soils outside the burn pit as well as within the pit. Moreover, not all of the unburned propellant remaining after the firebrands have burned out can be promptly retrieved. The AP, and perhaps some of the trace products of incomplete combustion, would potentially enter surface water and leach into ground water. Ground water monitoring techniques are available to evaluate any potential contamination.

#### 4.3.4.2.2 Other Methods

Potential impacts to surface waters from incineration and the washout method of elimination would likely be minimal. Treatment of washout effluent, to remove pollutants prior to release into sewage or drainage infrastructures, could decrease the potential adverse impact to surface waters. Adequate scrubbing of emissions from an incinerator

may decrease the potential for surface water contamination caused by pollutants being washed out of the atmosphere by rain or snow.

Scrubbing static fire exhaust or implementing the washout method of elimination will result in a potential increase in water demand. If either were performed at Hill AFB, there would be a major impact because obtaining fresh water at this facility currently requires the use of reverse osmosis.

A NPDES permit may be required for any discrete discharges to surface waters, unless these discharges are specifically exempted. For example, washout water produced by removal of propellant from a rocket motor could not be discharged directly to a surface water body unless a NPDES permit was obtained. Preparation of the permit application, State or EPA review, and a thirty-day public comment period are factors that influence the time required for obtaining a permit.

Construction of new storage facilities for rocket motors in a wetland area may be prohibited under the requirements of Section 404 of the Clean Water Act and Executive Order 11990, Protection of Wetlands. Floodplain maps would need to be consulted and alternatives and mitigations considered according to Executive Order 11988, Floodplain Management, if construction of new storage facilities is planned in a 100-year floodplain area.

#### 4.3.4.3 Potential Mitigation

A liner, such as a concrete pad, could be placed in the expected static fire blast area to intercept any deposited material. This pad could end in a deflector to divert the combustion products upward, thereby minimizing the amount distributed on the pad, or in the general area. Potential impacts on ground water could be minimized by such a barrier as long as the barrier remained waterproof. Because of the high temperatures associated with rocket exhaust, and pad movement caused by rocket thrust, cracks could be expected in a concrete pad. Theoretically, this could allow contaminants into the ground water unless an impermeable liner is installed under the pad. Lime could be added, if necessary, to nearby surface waters to help control pH.

Constructing lined burn pits, a leachate collection/treatment system, and a storm water collection/treatment system would lessen the possibility for surface and groundwater contamination. Potential impacts to surface or ground waters from open detonation at those facilities where ground water is at or near the surface could be minimized by avoiding those areas within the facility, or by not planning to conduct open detonation in pits at a particular facility. Contamination of surface water bodies could be avoided by locating the burn pits more than 200 feet (62 m) away from them. Such a location could prevent firebrands from landing in these water bodies.

## 4.4 GEOLOGY/SOILS

The criteria used to determine the significance of impacts on earth resources consider soils, geology, energy, and mineral resources. Impacts will be significant if they result in the depletion of regional resources, trigger major geologic hazards, or change the characteristics of the soil. There will be moderate- to low-level impacts if portions of the resource are affected, or the value of the resource in that particular area is not important. Beneficial impacts will occur if the resource was restored or a hazard neutralized by the proposed action.

### 4.4.1 ICBM DEPLOYMENT BASES

#### 4.4.1.1 Analysis Methods

The analysis for this portion of the document was based on a literature review of existing data and publications for potentially affected and related locations. The review centered on the locations' geology, mineral resources, and soils. The sites and their overall value as a regional resources were noted. Potential, specific hazards due to existing ground disturbance were defined for all sites.

Identification of actual impacts on earth resources will occur at the site-specific level of analysis. Resource identification will involve interviews with knowledgeable personnel, reviews of geological and soil survey materials, and on-site field investigations.

#### 4.4.1.2 Potential Impacts

The elimination of missile silos will have significant impacts on the geology and soil resources in the vicinity of the ICBM deployment areas. The level of significance will depend on the number of silos to be eliminated in any given region.

The explosive demolition activities could induce strong ground motion in areas of local or regional geologic faulting. The potential for a significant impact is minimal, in most of the regions, since the silos are primarily located in tectonically inactive areas. Constructing facilities at a distance greater than 25 miles from an active fault will result in minimal impact to structures during earthquakes (16). Ellsworth AFB is located in an area of swelling and shrinking soils, and it is possible that the localized faulting in this area may be further triggered by the blasting process. This could induce slumps or block slides, which are typical in the Pierre Shale soil. A site-specific analysis will be needed to verify this.

Liquefaction occurs when saturated granular soils are subject to strong ground motion resulting in a loss of soil strength. Liquefaction requires a geologic and hydrologic environment in which sands and silts were deposited during the last 10,000 years, and with ground water about thirty feet below the surface (36). Water tables within thirty feet

of the surface in sandy, tectonically active areas could be susceptible to liquefaction and loss of bearing strength in soils (i.e., ground failure). The Ellsworth AFB deployment area has active local faulting and could be susceptible to liquefaction. The level of potential impact will be determined during site-specific level of analysis.

During the blasting process, the previously discussed liquefaction hazards could permanently impact parts of a local or regional aquifer. Settling and compacting of the aquifer sediments could occur, temporarily or permanently changing the aquifer's permeability and effective porosity. (See Section 4.3.2.)

Potential impacts on the soil resources from the elimination activity include possible erosion of the disturbed soils from wind or water. Fugitive dust generation and modification of terrain are other possible impacts.

Detonation of explosives at the silos will produce sound waves of sufficient strength to disturb rocks and weak soils in mountainous or sloping regions. These acoustical disturbances could lead to rock falls, landslides, or slumping, and this potential impact will need to be verified on a site-specific basis.

This method of silo elimination could potentially disrupt and alter the present geology of deployment areas. Altering the geology could result in more restricted or difficult access to strategic and critical mineral deposits or to critical energy resources. The proposed action may also impact the mineral deposits by altering the topography and exposing the minerals to degradation or disruption. Rare or important paleontological specimens could also be destroyed. Site-specific analysis of geological resources will provide a more accurate evaluation of the potential adversity of impacts associated with silo elimination.

#### 4.4.1.3 Potential Mitigation

Any potentially significant adverse impacts to the earth resources will require mitigation. Impacts could be lessened by selectively placing explosives in the structurally weakest locations of the silos. Less explosive charge, but more detonations during demolition, could be used to lessen noise and shock waves and minimize damage to the geology and soils. Silt screens could be placed in drainage ways to trap soils and reduce erosion impacts. Periodic watering of soils will suppress dust and minimize wind erosion.

### 4.4.2 HEAVY BOMBER STORAGE, CONVERSION, OR ELIMINATION FACILITIES

#### 4.4.2.1 Analysis Methods

The analysis methods used to determine potential impacts at the heavy bomber storage, conversion, or elimination facilities are similar to the methods used at the ICBM deployment bases. See Section 4.4.1.1 for this discussion.

#### 4.4.2.2 Potential Impacts

The potential increase in the handling, generation, and storage of hazardous wastes due to increased activity at the heavy bomber storage, conversion, or elimination facilities could result in increased contaminated runoff beyond the capacity of the oil/water separator. Excess runoff will then have the potential to contaminate soils. The significance of the impact will depend on the number of aircraft involved. Pollutants from the storage or conversion of the heavy bombers may be washed out of the work area or defueling pad and onto the soils resulting in further damage to the resource.

The level of storage, conversion, or elimination may require construction of new facilities at Davis-Monthan, Tinker, or Kelly AFBs. The impact to soils caused by potential wind and water erosion during the construction of new facilities will be negligible with proper mitigation.

#### 4.4.2.3 Potential Mitigation

Storage of all bombers in an arid, dry, desert environment could minimize geological and soil hazards. The likelihood of solvents, fuel, or hydraulic fluids damaging the geology or soils could be minimized by ensuring the proper handling, storage, and disposal of these items.

Because the soils are highly erodible at Davis-Monthan AFB, prevention measures could be taken to reduce potential impacts on the earth resources. These measures include stabilizing the soils in the storage areas by windbreaks or pavement and implementing erosion control techniques during the construction of any new facilities.

### 4.4.3 MISSILE STORAGE, CONVERSION, OR ELIMINATION FACILITIES

#### 4.4.3.1 Analysis Methods

The analysis methods used to determine potential impacts at the missile storage, conversion, or elimination facilities are similar to the methods used at the ICBM deployment bases. See Section 4.4.1.1 for this discussion.

#### 4.4.3.2 Potential Impacts

The elimination of nondeployed missile motors will have potential impacts on geology and soils. The level of significance will depend on the number of missile motors to be eliminated at any given facility.

The effects on the physical environment of either static fire or open detonation will be directly related to the size of the area required for each method, including structures, roads, and buffer areas. Since different-sized areas are required for the static fire and

open detonation methods, the extent of the effects on the physical environment will differ. Once the physical environment is altered, drainage patterns can change, runoff increase, and permeability decrease, especially in those areas with concrete structures or paving.

Deposition of exhaust residues including HCL and $AL_2O_3$ will occur on soils in the vicinity of static fire sites. The pH of soils could be lowered by HCL, and the aluminum oxide concentration would be raised. The magnitude of the impact will depend on the amount of dispersion prior to deposition and the buffering capacity or bicarbonate level of the soils. The buffering capacity and resultant soil pH will influence the solubility of deposited aluminum. Alkaline soils will not result in solubilized aluminum while more acidic soils will result in solubilized aluminum. Soils at current elimination sites are mildly alkaline. Thus, aluminum will not be released into the nutritive cycle of any vegetation as a result of static firing or open burning emissions. The aluminum generated by the elimination of rocket motors will most likely become mixed into the soils without any adverse effects. A monitoring program could effectively determine total soluble aluminum concentrations and pH of the soil. Aluminum deposited on soils could become washed into surface waters or leach into ground water. See Section 4.3.4.2 for a discussion of associated water resource impacts.

Impacts on soils such as wind and water erosion from the possible construction of facilities to eliminate missiles by washout, incineration, and other methods will likely occur. The potential impact on soils will be addressed in greater detail at a site-specific level of analysis should these options be chosen and new facilities required. Reducing the number of deployed missiles will lead to potential soil impacts from the possible construction of additional missile storage "igloos" if the storage option is exercised. The impact to soils from "igloo" construction will also be the result of wind and water erosion of exposed or disturbed ground.

#### 4.4.3.3 Potential Mitigation

Given the potential for soil erosion at each of the elimination and storage sites under consideration, soil erosion control measures could be implemented during construction. Soil erosion could also be minimized by implementation of erosion control measures during either static firing or open detonation. Should the static fire method of elimination be used to reduce the number of nondeployed missile motors, appropriate measures such as construction of a concrete pad or placement of rip-rap in the rocket blast area could be used to minimize soil erosion. Exhaust deflectors would aid dispersion of emissions and reduce near-field concentrations of aluminum and HCL. Appropriate restoration and reclamation of the site could be implemented such that long-term effects (increased runoff, decreased permeability, erosion potential) on the physical environment would be minimized.

## 4.5 CULTURAL RESOURCES

The criteria used to determine the significance of impacts on cultural resources include the effects on NRHP eligibility, future research potential, or suitability for religious or traditional uses. Impacts will be significant if they result in the loss or destruction of resources listed, or eligible for listing, in the NRHP, or considered important to Native Americans. There will be moderate to low level impacts if portions of the resource are affected, or the value of the resource in that particular area is not important. Beneficial impacts will occur if the resource were protected or reconstructed by the proposed action.

### 4.5.1 ICBM DEPLOYMENT BASES

#### 4.5.1.1 Analysis Methods

The analysis for this portion of the document is based on a thorough review of existing data and publications for potentially affected locations. The review centered on whether the locations had been surveyed for cultural resources, and to what extent the survey was completed. The number of recorded sites and their overall value to the resource in the region was noted, along with any sites that were listed, or are eligible for listing, in the NRHP, and the proximity of the locations to present day Indian reservations. Particular emphasis was given to existing ground disturbance to define those areas where intact resources may potentially occur. This review of available literature indicated the likelihood of there being cultural resources which could be affected by Treaty-related activities.

Identification of actual impacts on cultural resources will occur at the site-specific level of analysis. Resource identification will involve interviews with the State Historic Preservation Office, archives reviews, and on-site field surveys. Native American tribes may need to be consulted to identify any materials or sacred areas potentially affected by the proposed action.

#### 4.5.1.2 Potential Impacts

Ground disturbance during the elimination and restoration of the silo locations could cause short- and long-term impacts on archaeological resources, if any were present in the immediate area. This disturbance could diminish or destroy the value of the resource by removing all or a portion of it. This loss of a resource, and its research potential, will be significant; however, the silo locations have been extensively disturbed and modified over the years. Thus, the likelihood of there being intact resources in those immediate areas is minimal.

Ground shaking that may occur during the demolition of the silo could physically damage or alter any historic properties in close proximity to the silo locations. This could result in a long-term impact to the property's characteristics that qualify it for inclusion to the

NRHP. This impact will be considered significant. Information was not available for this study to determine whether there are any such historic properties near silos.

The resultant noise from the blasting activity could have short-term impacts on Native American communities in the vicinity. Such aural intrusion will be significant if it disrupts religious or traditional activities. Again, detailed information on the proximity of any such communities was not available for this study.

### 4.5.1.3 Potential Mitigation

Cultural resources listed, or eligible for listing, in the NRHP are provided protection under Federal law. Mitigation measures differ depending on the type and the extent of potential impacts to the resource. A programmatic agreement with the Advisory Council on Historic Preservation (ACHP) would specify measures for protecting important cultural resources.

The most effective means of mitigating significant impacts would be to avoid the resource. Timing of the blasting activity could be delayed to avoid Native American religious or traditional ceremonies. However, where avoidance is not feasible, other mitigation measures could be implemented. This could include documenting and analyzing data from the listed or eligible NRHP sites prior to their alteration or destruction, monitoring the dismantling activities to ensure protection of previously unrecorded resources, and implementing alternative engineering designs to lessen the magnitude of the impact.

## 4.5.2 HEAVY BOMBER STORAGE, CONVERSION, OR ELIMINATION FACILITIES

### 4.5.2.1 Analysis Methods

The analysis methods used to determine potential impacts at the heavy bomber storage, conversion, or elimination facilities are similar to the methods used at the ICBM deployment bases. The reader is referred to Section 4.5.1.1 for this discussion.

### 4.5.2.2 Potential Impacts

The proposed action could result in ground disturbance from any construction or expansion activities that may be necessary to accommodate the storage, conversion, or elimination of the bombers. The disturbance could cause short- and long-term impacts on the archaeological resources by removing all or a portion of the resource, diminishing or destroying its value. This loss of a resource and its research potential will be significant.

The remodeling of any buildings could cause a long-term impact on a cultural resource if the particular building possesses an architectural value, or is listed, or eligible for listing, in the NRHP. This physical alteration and loss of a distinct resource characteristic will be significant.

Overflight activity as the bombers arrive at the facilities will have short-term impacts on any Native American resources in the vicinity. This aural and visual intrusion will be significant if it disrupts religious or traditional activities.

#### 4.5.2.3 Potential Mitigation

Mitigation measures differ depending on the type and the extent of the potential impacts to the resource. For those resources listed, or eligible for listing, in the NRHP, a programmatic agreement developed with the ACHP would specify measures for protecting the important resources.

The most effective means of mitigation would be to avoid impacting the resource. This could involve scheduling overflight activity to avoid conflicts with Native American religious or traditional ceremonies, and the siting of construction or expansion activities outside the resource area. However, where avoidance is not feasible, other mitigation measures could be implemented, such as documenting and analyzing data from the listed or eligible NRHP sites prior to their alteration or destruction; monitoring the construction or expansion activities to ensure protection of previously unrecorded resources; and engineering design to lessen the magnitude of the impact.

### 4.5.3 MISSILE STORAGE, CONVERSION, OR ELIMINATION FACILITIES

#### 4.5.3.1 Analysis Methods

The analysis methods used to determine potential impacts at the missile storage, conversion, or elimination sites are similar to the methods used at the ICBM deployment bases. The reader is referred to Section 4.5.1.1 for this discussion.

#### 4.5.3.2 Potential Impacts

The proposed action will result in ground disturbance from any construction or expansion activities that may be necessary to accommodate the storage, conversion, or elimination of the missile rocket motors. This could include constructing new storage buildings and open detonation pits. The disturbance could cause short- and long-term impacts on any archaeological resource by removing all or a portion of that resource, diminishing or destroying its value. This loss of a resource and its research potential will be significant.

Modifying any existing buildings will cause a long-term impact on a cultural resource if the particular building is listed, or eligible for listing, in the NRHP or possesses an unique architectural value. This physical alteration and loss of a distinct resource characteristic will be viewed as significant.

The resultant noise and smoke plume from the possible burning and firing of rocket motors could have short-term impacts on Native American resources in the vicinity. This

aural and visual intrusion will be significant if it continually disrupts the religious or traditional activities of the Native Americans.

### 4.5.3.3 Potential Mitigation

Scheduling of any rocket motor elimination to avoid conflicts with the timing of Native American religious or traditional ceremonies would be the most effective way of mitigating an impact to this resource. Another mitigation measure of avoidance would be to physically site any construction outside the resource area.

Where avoidance is not feasible, other measures that could be implemented include documenting and analyzing data from known sites prior to their alteration or destruction, monitoring the construction activity to ensure protection of previously unrecorded resources, and engineering design to lessen the magnitude of the impact.

Any impacts to NRHP listed or eligible sites would involve the development of a programmatic agreement with the ACHP to identify mitigation measures for protecting the resource.

## 4.6 VISUAL RESOURCES

Visual resources are the physical characteristics comprising the landscape that can be seen within a single view. The importance of the resource, or its aesthetic value, is influenced by social considerations including public awareness and sensitivity to the resource.

The criteria used to determine the significance of impacts on the visual resources focused on the changes to the physical characteristics of the landscape, and to what degree those changes will be perceived by the public as unacceptable. If the visual resource is restored or reclaimed, a beneficial impact will occur.

### 4.6.1 ICBM DEPLOYMENT BASES

#### 4.6.1.1 Analysis Methods

The analysis for this portion of the document was based on a literature review of existing data and publications for all potentially affected locations. The review centered on whether the physical characteristics of the locations will be generally perceived as having an unique aesthetic value. It was also noted whether there was a variety of visual resources in the location, and if any were afforded protection under regulatory statutes. Particular emphasis was given to existing disturbances and whether the visual resource was readily observable by the local population.

Identification of actual impacts on visual resources will occur at the site-specific level of analysis. This will involve assessment of the resource from on-site field surveys, use of visual resource management plans of Federal agencies to determine the importance of the resource, and interviews with the local populace to define aesthetic value and levels of acceptable change.

#### 4.6.1.2 Potential Impacts

The proposed action will disrupt the visual landscape during the demolition and restoration of the silo location. For verification purposes, several months may pass between silo elimination and the beginning of site restoration. This disruption will diminish the value of the resource, but the impact will be short-term. This impact will be considered negligible at most locations because of the distance from the local populace.

The goal of restoration activities will be to emulate the surrounding landscape. Because the silos are not currently a natural part of this landscape, this activity will be a long-term beneficial impact.

#### 4.6.1.3 Potential Mitigation

The resulting long-term beneficial impacts to the visual resources would require no mitigation because the impacts could be viewed, in and of themselves, as a means of mitigation.

The most effective mitigation measure is avoidance. Since the silo locations are not mobile, it is not possible to avoid potential physical changes to the resource. However, timing and scheduling of the elimination activity could be accomplished so as to avoid the local populace and their perception of the activity on the resource. For those locations within the national forest, the silo elimination could be scheduled so as to avoid the times of year when visitation to the area is the highest.

### 4.6.2 HEAVY BOMBER STORAGE, CONVERSION, OR ELIMINATION FACILITIES

#### 4.6.2.1 Analysis Methods

The analysis methods used to determine potential impacts at the heavy bomber storage, conversion, or elimination facilities are similar to the methods used at the ICBM deployment bases. See Section 4.6.1.1 for this discussion.

#### 4.6.2.2 Potential Impacts

The storage of bombers will affect the visual landscape around Davis-Monthan AFB. The number of bombers to be stored and the distance of the facility from the local populace will determine the degree of visual disturbance as open space becomes occupied.

#### 4.6.2.3 Potential Mitigation

Visual disturbance from the storage of bombers at Davis-Monthan AFB is an unavoidable impact (see Section 4.12.2) and no reasonable, feasible mitigation measures are identified.

### 4.6.3 MISSILE STORAGE, CONVERSION, OR ELIMINATION FACILITIES

#### 4.6.3.1 Analysis Methods

The analysis methods used to determine potential impacts at the missile storage, conversion, or elimination facilities are identical to the methods used at the ICBM deployment bases. The reader is referred to Section 4.6.1.1 for this discussion.

#### 4.6.3.2 Potential Impacts

The proposed action could disrupt the visual landscape during the burning and firing of the rocket motors. The resultant plume formation from the motor elimination could diminish or destroy the value of the resource. However, because the Treaty does not actually require rocket motors to be eliminated, open detonation or static firing of motors could be timed so as to prevent significant build-up of smoke and subsequent disruption to any visual landscapes. If the plume formation is readily observable to the local populace, the impact on the visual resource could be considered significant.

#### 4.6.3.3 Potential Mitigation

The most effective means of mitigating significant impacts would be to avoid the resource. However, when avoidance is not feasible, measures could be implemented to reduce the significance of the impact. This could include delaying the burning or firing activity when weather conditions would prevent the rapid dissipation of the plume, siting the burn pit to create the greatest distance possible from the local populace, and engineering design to lessen the magnitude of the impact.

## 4.7 TRANSPORTATION

The heavy bomber deployment bases and the heavy bomber storage, conversion, or elimination facilities are not expected to experience transportation impacts due to the proposed action. Therefore, a discussion of the environmental consequences of the proposed action for these locations is not presented in this section.

### 4.7.1 ICBM DEPLOYMENT BASES

#### 4.7.1.1 Analysis Methods

The analysis was based on relevant information from existing documents pertaining to the ICBM deployment bases. Identification of actual impacts on transportation will occur at the site-specific level of analysis. Resource identification will involve identification of specific traffic conditions in the vicinity of the affected site. This level of analysis for roadway traffic will involve specific project descriptions, interviews with appropriate departments of transportation and responsible managing parties, and on-site field surveys.

#### 4.7.1.2 Potential Impacts

The shipment of missile components as a result of the proposed action will cause increased degradation of road networks near the deployment bases. This potential impact is currently not quantified, but is likely to be minimal because the roads between bases and the silo locations are currently maintained to handle the passage of missile erector-loader vehicles on a regular basis. To the extent that any road or segment is incapable of sustaining those loads without damage, there would be an existing level of impact - a yearly increment of road damage under the present situation. The proposed action will result in an increased number of missile component movements per year for several years, which will accelerate road damage. Heavy equipment needed for silo demolition will result in additional, more frequent loads on the local networks, further accelerating damage to roads.

The increased frequency of missile movement will likely cause increased local traffic congestion. Missile movement is accomplished via a slow-moving convoy. If the frequency of such convoys were to temporarily increase, this would increase the frequency of interference with traffic in and near the support base communities, and with the local farmers' moving of machinery to and from their fields.

Road degradation and traffic interference problems during the missile removal and launcher elimination period, and the specific potential for increases in those problems, are issues that will be addressed in subsequent tiers of analysis. Decreased road use following missile removal and silo elimination will reduce road degradation and traffic congestion, which would be considered a beneficial, long-term impact.

### 4.7.1.3 Potential Mitigation

Mitigation measures could include improving or modifying traffic signals at potentially affected intersections, scheduling missile convoys to avoid current peak traffic hours, increasing the general maintenance and site-specific rehabilitation of project-related rural roadways.

## 4.7.2 MISSILE STORAGE, CONVERSION, OR ELIMINATION FACILITIES

### 4.7.2.1 Analysis Methods

The analysis to determine potential impacts on the transportation network around the missile storage, conversion, or elimination facilities was similar to the analysis used at the ICBM deployment bases. The reader is referred to Section 4.7.1.1 for this discussion.

### 4.7.2.2 Potential Impacts

Potential impacts to the transportation network (i.e., road damage, traffic tie-ups, etc.), similar to those identified at the ICBM deployment bases, may also occur at the missile storage, conversion, or elimination facilities. Transportation impacts associated with the accident potential of various modes of transport from the movement of the missiles from the deployment bases to the storage, conversion, or elimination facilities are addressed in Section 4.9.2.2.

Procedures and safety guidelines have been developed as a result of regular maintenance schedules and past treaty requirements for the transportation of missiles within the storage, conversion, or elimination facilities. Past experience and proven methods of transportation substantially limit the likelihood of any adverse transportation impacts within the facilities. If increased personnel are needed for elimination activities, slight traffic increases will result, but are unlikely to be sufficient to cause increased congestion.

Static firing or open detonation of missiles could interfere with road traffic if it becomes necessary to close roads because of reduced visibility caused by plume formation. This safety precaution is possible, but unlikely to be needed.

### 4.7.2.3 Potential Mitigation

Mitigation measures, similar to those identified in Section 4.7.1.3, could be implemented to minimize the significance of any potential impacts.

# 4.8 BIOLOGICAL RESOURCES

Native or naturalized plants and animals, and the habitats in which they occur, are collectively referred to as biological resources. Of particular importance are those plant and animal species that are listed as threatened or endangered by the USFWS. The issues and concerns relate to the potential degradation or elimination of local biotic communities and adverse effects on the ecosystem. The potential effects could result directly or indirectly from the implementation of the Treaty.

Different criteria are used to determine the significance of impacts to the aquatic, vegetation, and wildlife resources. A potential impact will be significant if it results in loss of a threatened or endangered plant or animal species, or a reduction in population levels that jeopardizes its viability. An impact will also be significant if existing fish and wildlife populations are eliminated or reduced to levels which threaten continued recreational use of these populations, unique habitats are destroyed, or disturbed areas are not likely to be successfully revegetated with diverse native species within a few years. Impacts will be beneficial if the biological resources are protected, enhanced, or restored.

## 4.8.1 HEAVY BOMBER DEPLOYMENT BASES

### 4.8.1.1 Analysis Methods

As discussed in section 3.8.1, biological resources at the deployment bases will remain unchanged and unaffected; thus, they are not discussed in this section. However, the withdrawal of aircraft from the deployment bases could have potential effects to the biological resources in the training routes and weapons ranges. The analysis for this portion of the document was based on a broad review of applicable data sources, such as NEPA documents for air space operations, aircraft retirements, base closures and realignments, and force structure changes.

No site-specific analysis would be required unless mission changes and reassignment of bombers resulted in increased activity in a specific route or at a specific range.

### 4.8.1.2 Potential Impacts

Reduced numbers of aircraft operations will likely have beneficial impacts on the biological communities in the vicinity of the training routes and weapons ranges. Beneficial impacts include less disturbance to noise receptors, migratory bird flyways, and breeding animal species. The duration of these beneficial impacts will be dependent on aircraft reassignment and future mission changes at the deployment bases. No adverse impacts to Federally listed or candidate, or state-recognized threatened and endangered species, or their habitat will occur as a result of less activity in the ranges and routes.

#### 4.8.1.3 Potential Mitigation

The impacts resulting from the proposed action are expected to be beneficial in nature; thus, no potential mitigation is anticipated.

### 4.8.2 ICBM DEPLOYMENT BASES

#### 4.8.2.1 Analysis Methods

Data collected for NEPA documents for missile activities, force structure changes, and construction projects were used to evaluate and assess various potential impacts on the biological resources at the ICBM deployment bases.

Identification of actual impacts to biological resources will occur at a site-specific level of analysis. This will involve consultation with the USFWS and other appropriate agencies, conducting terrestrial and aquatic field surveys, and identifying specific locations of any threatened or endangered species. This will be followed by a determination of the degree to which the particular attributes of the biological resource are affected by the proposed action and the significance of this effect.

#### 4.8.2.2 Potential Impacts

The potential impacts resulting from increased activity around the missile deployment bases will be short-term, the length and extent of the impacts depending on the rate of missile removal and silo elimination. If the silos and support facilities are to be totally dismantled or eliminated, then the construction related impacts would be more severe. Placing the LF and LCF in caretaker status will result in far fewer impacts to the biological communities in the vicinity of these facilities. The extent of these impacts will be determined in the next level of analysis.

The potential short-term impacts to the vegetation include removal or disturbance of the existing ground cover, introduction of undesirable weed species, and reduced productivity or palatability.

Reestablishing ground cover in the immediate vicinity of the LCFs and LFs may involve removal of existing soil that may be contaminated with particular herbicides such as triazine or soil sterilants, backfilling with uncontaminated soil, and reseeding. Site elimination and restoration may be subject to Section 103(c) of CERCLA which requires site-specific assessment of potential threats to the environment, including biota, if the LCF or LF site are considered a hazardous waste site due to the herbicide contamination.

Any contaminated soil around the LCFs and LFs will be considered a RCRA hazardous waste if it is ignitable, corrosive, reactive, or toxic. The herbicide would be considered a hazardous waste only if it was discarded prior to use or was a spill residue. Because

the herbicide was likely applied as a commercial chemical product, it is not in itself considered a hazardous waste (37).

The demolition and restoration activities could have potential short-term impacts on wildlife, including threatened or endangered species. Resident species could experience temporary population displacement, increasing the competition for available habitat. The increased human activity and noise levels could decrease breeding and nesting success, which would be considered a significant impact if the species of concern is listed as threatened or endangered.

Potential impacts to the water quality from increased siltation, turbidity, or introduction of petroleum products could ultimately cause a loss of or degradation of the aquatic habitat and fishery. (See Section 4.3.2.)

The level of significance of the potential impacts on vegetation, wildlife, and the fishery will depend on the rate and extent of silo elimination. The time of year will also influence the significance of the impact.

#### 4.8.2.3 Potential Mitigation

Mitigation could include timing the blasting activity to minimize disturbance during breeding and nesting seasons, and during pronghorn migration, avoiding the demolition of all the silos within one flight at the same time, and revegetating the silo locations with native plant communities. Consultation with the USFWS will result in identification of other mitigation measures for the protection of threatened or endangered species.

### 4.8.3 HEAVY BOMBER STORAGE, CONVERSION, OR ELIMINATION FACILITIES

#### 4.8.3.1 Analysis Methods

The analysis to determine potential impacts on the biological resources at the storage, conversion, or elimination facilities is similar to the analysis used at the ICBM deployment bases. See Section 4.8.2.1 for this discussion.

#### 4.8.3.2 Potential Impacts

The proposed action will have potential impacts to the biological resources if human activity increases and any ground disturbance results from construction projects. Tinker and Kelly AFBs are highly industrialized with sufficient ramp space. It is assumed that no additional construction will be needed to facilitate the conversion process; thus, any potential impacts to the resource at the logistic centers will likely be negligible.

Portions of the storage area at Davis-Monthan AFB are native vegetation. If the proposed action results in additional construction, any proposed Treaty-associated

AMARC construction projects will be within the established area with the potential for ground disturbance. Thus, potential impacts to the resource could occur. Ground disturbance in a new or a previously disturbed area influences the potential adversity of the impact. A long-term loss of available vegetation and habitat could result, followed by the introduction of undesirable weed species and reduced productivity. This will be considered a significant impact if any threatened or endangered species are present, unique habitats are destroyed, or the disturbed areas are not likely to be successfully revegetated with diverse native species within a few years.

The loss of habitat would impact resident wildlife, possibly including threatened or endangered species. Wildlife could be permanently displaced causing competition for the remaining habitat, and breeding and survival rates could decrease due to increased human activity. This will also be considered a significant impact if the species of concern is listed as threatened or endangered, unique habitats are destroyed, or the disturbed areas are not likely to be successfully revegetated with diverse native species. Potential impacts to the water quality from increased runoff of soil and petroleum products would ultimately cause a loss of, or degradation of, any aquatic habitat or fishery in the vicinity.

The level of significance of the potential impacts to the biological resources will depend on the magnitude of the conversion and storage operations, and the extent of any construction projects. This will need to be determined during the next level of analysis.

#### 4.8.3.3 Potential Mitigation

The most effective means of mitigation is to avoid potential impacts. Applicable mitigation could be to relocate the expanded storage area at AMARC to avoid disturbing any threatened or endangered species that are known to occur in the vicinity. If this is not possible, consultation with the USFWS could identify other mitigation measures for the protection of threatened or endangered species. Other measures to reduce the significance of an impact include restoring and reestablishing native vegetation on disturbed areas once the project is complete and minimizing activities during breeding seasons for sensitive species.

### 4.8.4 MISSILE STORAGE, CONVERSION, OR ELIMINATION FACILITIES

#### 4.8.4.1 Analysis Methods

Analysis of biological resources includes the evaluation of impacts to native or naturalized plants and animals and the habitats in which they occur. This analysis combines the impacts to biological resources at all potential storage, conversion, or elimination facilities because the impacts at all sites originate primarily from the effects of combustion products from rocket propellant and potential construction-related impacts. Attention is also given to impacts on threatened or endangered species and species under consideration for listing as threatened or endangered.

### 4.8.4.2 Potential Impacts

Potential impacts at the missile storage, conversion, or elimination facilities will originate from the effects of rocket motor exhaust on biota. $Al_2O_3$, one of the major emissions products, is a fine particulate which will settle to the ground over a wide area. Some sensitive freshwater organisms could potentially experience effects from excess aluminum concentrations (34). However, emissions monitoring of a Pershing rocket motor static firing suggest that the $Al_2O_3$ will not likely settle in detectable quantities. Wherever it does settle, $Al_2O_3$ will not likely become solubilized due to the alkaline condition of most water and soils (see Sections 4.3.4.2 and 4.4.3.2). Therefore, $Al_2O_3$ will be very unlikely to cause any biological effects. Moreover, aluminum is already a major constituent of the soil at virtually any location. HCl as a gas, and as an acid when dissolved in water, can directly damage vegetation, but the predicted ground level concentrations may be insufficient to cause vegetation damage based on a review of literature presented in a report on static firing (24). In the soil, HCl can be rapidly and completely neutralized due to the natural alkalinity of most soils. This neutralizing capacity of soil downwind of motor burning will not be exhausted during any foreseeable motor elimination program.

Increased personnel activity, elevated noise levels associated with refurbishment of facilities, and potential construction of new facilities would result in temporary disturbances to wildlife in the immediate vicinities. These disturbances would be of short duration and not have significant long-term impacts. Further analysis of impacts to biota and threatened and endangered species will be needed if new facilities are to be constructed or the level of activity at existing facilities increases.

### 4.8.4.3 Potential Mitigation

Mitigation to vegetation and wildlife could result from preventing potentially harmful emissions from occurring through the use of more advanced elimination technologies. The use of best available technology could serve to reduce, contain, or alter potentially harmful emissions. Burning activities could be conducted when wind speeds and direction encourage appropriate dispersal of emissions. Possible endangered species impacts may be minimized by the siting process and seasonal launch and burn restrictions. Additional mitigations of threatened and endangered species could be identified through consultations with the USFWS.

## 4.9 HUMAN HEALTH AND SAFETY

The handling, storage, and conversion or elimination of heavy bombers and ICBMs is not a new action for the Air Force. The issues discussed here relate to the potential impacts that such actions could have on human health and safety.

For each method of elimination for both bombers and missiles, potential short-term occupational safety and health concerns are likely to increase with the level of activity. For bombers, these concerns would originate from the increased handling of fuels, greater noise levels, or potential accidents throughout the process. For missiles, these concerns would originate from potential transportation accidents, construction mishaps, or possible exposure to hazardous substances. A detailed identification of impacts for strategic weapons systems and deployment, storage, conversion, and elimination facilities will be discussed in future site-specific environmental documents tiered to this LEIS.

### 4.9.1 HEAVY BOMBER DEPLOYMENT BASES

#### 4.9.1.1 Analysis Methods

The analysis for this portion of the document was based on a literature review of existing data and publications on human health and safety impacts for potentially affected locations. Identification of actual impacts to human health and safety will occur at the site-specific level of analysis. Necessary information could be collected through conversations with base operations personnel. Information gathered from personal interviews with base staff would complement published information about the aircraft accident potential; the handling, storage, and disposal of hazardous wastes; the handling, storage, and disposal of nuclear material; explosive safety; and transportation accident potential.

#### 4.9.1.2 Potential Impacts

The potential impacts of bomber storage, conversion, or elimination on human health and safety at the deployment bases are primarily positive since the proposed action has the potential to reduce the number of bombers deployed at a base. Fewer bombers in operation will reduce the potential for maintenance or operation accidents at the deployment bases. Fewer aircraft operations will result in a reduction in bird strikes, aircraft noise and emissions, and hazardous waste generation.

#### 4.9.1.3 Potential Mitigation

The impacts resulting from the proposed action are expected to be beneficial in nature and thus no potential mitigation is anticipated.

## 4.9.2 ICBM DEPLOYMENT BASES

### 4.9.2.1 Analysis Methods

Potential accidents during the handling and transportation of missile components, specifically boosters, will be a source of possible human health and safety impacts; therefore, the analysis focused on the three primary elements of such risks: the hazard/accident mechanism, the accident likelihood, and the severity of the human health consequences if such an accident were to occur. Military and civilian transportation statistics were used in addition to information obtained from knowledgeable military personnel. Hazardous wastes will be handled during missile removal and silo dismantlement. Further evaluations of the risk to human health and safety from handling these hazardous materials will be presented in environmental documents tiered to this LEIS.

### 4.9.2.2 Potential Impacts

Elimination of launch capability will involve the handling of wastes contaminated with sodium chromate solution, PCBs, and asbestos. Regulations issued by EPA and applicable state regulations will be followed when handling any hazardous waste found or generated at the deployment bases and silo launchers. These wastes are currently being handled at various bases.

The removal of missiles from their silos and transport to storage or elimination facilities pose a low risk of accidents during transportation, with an even lower risk that such accidents could result in human health (or environmental) damage. This evaluation is based on the following analysis:

Hazard/Accident Mechanism

The majority of the booster stages under consideration use a formulation of solid propellant that is designed to burn rapidly, but normally incapable of detonating. A smaller percentage of the rocket motors under consideration use liquid propellant. Solid propellant can be accidentally ignited by static discharge, lightning, impact, or by a nearby fire or explosion. Propellant can burn so rapidly that it has some partially explosive effect. That is, there could be a blast wave of the same strength that would be produced by an amount of explosive equal to roughly twenty percent of the solid propellant (12).

In the event of an accidental ignition of the solid propellant in the central cavity of a missile motor, the missile motor would develop propulsive force. However, the shipping fixtures are designed to restrain a motor that is ignited in a nonstandard manner. Uneven ignition, or ignition in the outer portions of the propellant, will result in a burn-through or rupture of the cylindrical casing, rather than developing propulsive force through the nozzle.

Currently deployed MM III and Peacekeeper missiles have sections (the Propulsion System Rocket Engine for MM III and the fourth stage of Peacekeeper missiles) containing hazardous liquid propellant, which will have to be handled, transported, and stored as part of the process to remove the missiles from deployed status. These sections are composed of a monomethyl hydrazine ($N_2H_3CH_3$) fuel tank and an oxidizer tank (nitrogen tetroxide [$N_2O_4$]). Accidental release of monomethyl hydrazine could result in both toxic and fire hazards. Should an accident result in the rupture of both tanks and mixing of the propellants take place, a fire and explosion would result. Current short-term safety, health, and environmental planning procedures account for the potential hazards associated with these propellants. This is also true for the sections of MM II and MM III that use liquid fuel in the liquid injection thrust vector control systems for attitude control.

Accident Likelihood

Three major modes of transport of missile motors could be used: air, rail, and road. For any shipment, regardless of mode, DOD personnel employ strict safety precautions to minimize the likelihood of an ignition accident.

Missiles are routinely shipped both to and from the missile silos, and routes are currently established to minimize the time spent traveling through population centers. Establishment of new routes for shipment of the rocket motors to different or new facilities will require some planning, as well as special handling procedures.

Missile boosters would be shipped in specially-designed shipping containers. The typical shipping containers are designed to provide a stable, shock-free environment for the boosters and to protect the boosters from the effects of weather during shipment. Some are designed to allow transportation and emplacement in a silo with the same fixture/container. All are designed to provide some degree of restraint given an inadvertent ignition (1).

Air Transport

Missile boosters have been shipped by cargo aircraft by the AF for the last thirty years. No precise data are available as to the number of flights, number of motors, or history of accidents, if any. The C-141 cargo aircraft used by the AF has a history of transporting weaponry, but accident statistics for this plane were not available for this study. US air carriers experienced an accident rate of $1 \times 10^{-3}$ per 1,000,000 aircraft miles flown in 1987 (15). If C-141 cargo aircraft accident statistics are similar, and a missile motor is transported roughly 1,000 miles from its deployed base to a logistic facility (a reasonable estimate of likely distance), the accident probability is one in one million. Data do not indicate the chance of accidental ignition of the transported motor. Assuming an extreme scenario that every accident involves ignition of the rocket motor, a very low probability exists that an aircraft carrying a missile motor would be involved in a crash or other accident that results in ignition of propellant.

Recently, it was discovered that the transport of MM size rocket motors by C-141s caused stress on the wings of the aircraft. Military airlift Command (MAC) expects refurbishment of the C-141s to be complete by the end of the 1991 calendar year.

Rail Transport

DOD and NASA have shipped missile motors by rail many times during the last thirty years, but, again, no precise information is available as to the overall total numbers of motors and the distances. It has been reported that 4,500 MM motors have been shipped, but the report did not specify whether any accidents occurred (4). Several hundred Space Shuttle rocket motors (similar to, but larger than missile motors) have been shipped from Utah to Florida without a single accident involving propellant ignition (12). The Navy has shipped all of their missile motors in their Fleet Ballistic Missile (FBM) program by rail car. Since 1963, FBM motors have travelled more than 4,861,500 miles with only four accidents having occurred. An accident is defined as an incident severe enough to require the destruction of the motors involved because of the potential reduction in reliability of the motor due to physical stress. The overall accident rate experienced by the Navy translates into an accident rate of $8 \times 10^{-7}$ which means that for every 1,000 mile trip there is a 0.08 percent chance of an accident, or less than one accident in every 1200+ trips. In fact, there has not been a rail car accident (using the definition just provided) involving a FBM motor since 1980. Additionally, there has never been a rail car accident involving an FBM motor that has resulted in the ignition, burning, or detonation of the motor.

Road Transport

The DOD has years of experience with this method, as with the other transport modes, including roughly 500,000 road miles transporting MM missiles with transporter-erector vehicles between the deployment bases and launch facilities. In roughly thirty years, only five rollover accidents have occurred, with none involving propellant ignition. For long distance shipments, from deployment base to logistic facility, specific data were not available. Data from the National Highway Transportation Safety Administration (22) indicate that the probability of any truck being involved in a major accident is on the order of $6 \times 10^{-8}$ per truck mile. For a 1,000-mile trip, a missile motor would have roughly one chance in 16,000 of being in a major accident. As in the "Air Transport" and "Road Transport" discussions, this statistic does not indicate the actual chance that the propellant would ignite. Special shipping containers reduce the possibility of a missile motor ignition from a traffic accident.

The low probabilities of accidents discussed for air, rail, and road transport should also be viewed in the context of new versus on-going activities. The Treaty Implementation program would result in the removal of some, as yet not specified, number of missiles from deployed status, and their subsequent shipment to storage or elimination facilities. The activities associated with the implementation program are not new and the level of

missile transportation activities will likely increase beyond that currently being conducted. Each of the six ICBM deployment bases, for example, typically transport 20-25 missiles per year from the launch facilities to the base, and then to a logistics facility for maintenance or refurbishment.

Accident Consequences

In the event that a transportation accident were to occur in which a missile motor were to ignite, the severity of the consequences would depend primarily on where the accident occurred and when it occurred. If an accidental ignition were to occur as a result of an air crash, a railroad derailment, or a highway accident, the consequences would be: fire and heat, a possible explosive blast, a possible propulsion of the rocket motor, and toxic emissions. The severity of the human health consequences would depend on the proximity to and number of people exposed. Similarly, environmental damage, such as damage to crops or other vegetation, would depend on the nature and proximity of such resources.

Missile motors being transported from deployment bases to logistic facilities will pass through or over various localities and settings, with a broad range of population densities and land uses. For example, a nominal 1,000 mile shipment of a missile motor from an ICBM base to a logistic facility could pass through agricultural areas with population densities on the order of one person per square mile, and could pass through at least portions of population centers with densities of 4,000 or more persons per square mile. A greater length of the trip would be through the more rural areas, but this cannot be quantified; nor can any differential accident likelihoods be identified for accidents in built-up areas versus rural areas.

If an ignition accident were to occur, the dispersion of toxic emissions is the likely major consequence that could be experienced outside of the immediate vicinity (i.e., a few hundred feet, if the motor does not take off) of the accident site. Qualitative analysis of open detonation, based on quantitative results of static fire modeling under weather conditions that inhibit rapid dispersion, indicates that the maximum concentration of emissions from open detonation at ground level will likely occur over an area of several square miles, but the concentration will be approximately two-thirds or less the health effects criterion discussed in Section 4.1.4. If this unlikely event were to occur in a populated area with a population density of 4,000 people per square mile, then several thousand individuals could be exposed for a period from a few minutes to approximately half an hour to concentrations of HCl not generally considered to pose a risk to human health. Some irritation of eyes, respiratory tract, and skin could occur in a few individuals.

An even more extreme case is conceivable; that is, an accidental ignition during a rainstorm. A propellant fire cannot be put out by water. While modelling data for such a scenario are not available, the emissions would likely be less dispersed and could reach

ground level at higher concentrations than in clear weather. However, the scrubbing effect of the rain could act to reduce the gaseous concentrations.

As indicated earlier, any transportation accident involving ignition of missile propellant is very unlikely. If such an unlikely event were to occur, health effects on nearby drivers or residents are far less likely in rural areas than in an urban setting. There is a possibility of damage to crops or vegetation from the resulting fumes and smoke, but the available evidence suggests that the short-term (several minutes) exposure would not harm crops or vegetation. The effects on plants under this extreme scenario, with consequent scrubbing of the HCl and $Al_2O_3$ into the rainwater, are unknown.

If a motor containing an explosive propellant were to be detonated in an accident, the shock wave and heat from the blast could damage vehicles and structures and injure individuals. Information on the potential area of such damage and on the combustion products and their dispersion was unavailable for this study. The motor also could fire and take off, breaking from the protective equipment. While the likelihood of this event taking place is small, the potential hazard is significant.

Summary of Transportation Risks

The likelihood of an accident involving ignition of a missile motor during transport is very low, but the consequences of such an unlikely event would likely be only temporary health effects on nearby drivers or residents. The specific accident likelihoods of the available transportation modes, and the consequences along specific routes, are topics which could be studied and compared in more detail in subsequent site-specific analyses.

#### 4.9.2.3 Potential Mitigation

Because of the low likelihood of accidents affecting human health and safety, no additional mitigation measures are proposed beyond the already stringent safety precautions used by DOD.

### 4.9.3 HEAVY BOMBER STORAGE, CONVERSION, OR ELIMINATION FACILITIES

#### 4.9.3.1 Analysis Methods

Analysis methods for bomber storage, conversion, or elimination facilities are similar to those discussed in Section 4.9.1.1 for the heavy bomber deployment bases.

#### 4.9.3.2 Potential Impacts

Prior to bomber dismantlement, "safing" of the aircraft must be accomplished. This entails the removal of explosives; the removal of hazardous materials and components; draining and purging of all aircraft fuel; and draining hydraulic fluids, liquid oxygen, and

other oils. Also, any radioactive materials or components must be identified, removed, and disposed of prior to dismantlement. After drain and purge procedures are complete, residual fuel remains in the fuel lines. The amount of fuel remaining would have to be determined in the event of bomber dismantlement. Aircraft prepping and subsequent conversion steps may increase the short-term impact on workers' exposure to noise, chemicals, and harmful emission products (primarily hydrocarbons). These potential short-term health and occupational hazards, and appropriate mitigation, should be addressed in greater detail if this method to remove bombers from deployment is chosen.

The Air Force conversion facilities currently dispose of all waste through the Defense Reutilization and Marketing Office (DRMO) located at each ALC. The DRMO stores the waste until it is disposed of through auctions and waste removal contracts. If removal can not keep up, a very large influx of "regular" waste from conversion activities could exceed the DRMO's storage space. A very large influx of hazardous waste (HW) would be even more of a problem as HW may only be stored in RCRA permitted facilities. The details and analysis of this potential impact will have to be addressed in site specific documents.

#### 4.9.3.3 Potential Mitigation

No additional mitigation measures have been identified, beyond the already stringent safety precautions used by DOD. Potential mitigation for short-term health and occupational hazards should be further defined in subsequent tiers of analysis.

### 4.9.4 MISSILE STORAGE, CONVERSION, OR ELIMINATION FACILITIES

The major human health and safety issues in regard to missile elimination include the toxicity of air emissions from static firing or open detonation and the possibility of blast effects and toxic emissions from an explosion. The toxicity of air emissions and associated potential impact to air quality and human health is discussed in Section 4.1.4.

#### 4.9.4.1 Analysis Methods

Analysis methods for missile storage, conversion, or elimination facilities are similar to those discussed for Section 4.9.11 for heavy bomber deployment bases.

#### 4.9.4.2 Potential Impacts

Health risks from storage of the rocket motors will likely be negligible because the motors will be stored according to quantity-separation distances; these distances are the minimum safe distances required to separate two given sites or buildings where at least one of the sites has a potential for explosion or fire.

Another possible source of health effects would be an accidental explosion of a rocket motor. The risks of accidents resulting in an uncontrolled detonation of a missile motor

were discussed in Section 4.9.2. A few of the motors (such as the MM II Stage 3) contain Class 1.1 propellant which is detonable, but no data were available as to the likelihood or magnitude of an accidental detonation. Class 1.3 propellants (AP-based) that comprise the majority of missile motors are categorized as non-detonable propellants.

There are several documented explosion incidents involving live rocket motors. These include the explosion of Titan rocket motors in 1988 at Hill AFB and 1990 at Edwards AFB; Peacekeeper Stage I at Thiokol in 1985; Peacekeeper Stage III detonation at Arnold Engineering and Development Center, TN in 1985; and a Pershing II in Germany in 1984. A Titan IV rocket motor containing 600,000 pounds of hydroxyl terminated polybutadiene propellant (88 percent solids) exploded while being static fired at Edwards AFB in early 1991.

Rocket motor elimination by means of static firing or open detonation will involve handling, treatment, storage, and/or disposal of rocket propellant, a reactive hazardous waste.

Generally, any person who treats, stores, or disposes of hazardous waste is considered an owner or operator of a treatment, storage, or disposal facility and must have a permit unless they are excluded. Concerning activities under START, rocket fuel is a reactive hazardous waste that could be burned (ignited) to dispose of the fuel. Therefore, such action constitutes an activity subject to permitting under 40 CFR 264, Subpart X, Miscellaneous Units. For new facilities, a permit must be obtained before physical construction of the facility. When EPA receives a "complete" permit application, it is not unreasonable to expect an additional two to three years to issue a permit. However, there are many static firing/open detonation facilities that are currently operating under "interim status," which is a legal authorization for an existing facility to operate pending final action on the permit application. These facilities may handle the static firing or open detonation of rocket motors and other items selected for elimination, provided that a revised Part A permit application and written permission is obtained from the appropriate authority under 40 CFR 270.72, prior to commencement of activities.

Rocket motor elimination also involves treatment, handling, and disposal of asbestos or asbestos-contaminated material. Asbestos, a cancer causing substance, is considered hazardous but not a hazardous waste. Asbestos treatment and disposal are regulated under the Clean Air Act's National Emission Standards for Hazardous Air Pollutants (NESHAPS) (37). Open detonation or static fire of various rocket motor types will require sampling and analysis to determine the level and content of emission products, specifically the presence of any hazardous emission products. Section 4.1.4 and 4.11.1 discuss potential asbestos emissions and impacts. The rocket motor casings will require asbestos lining removal before disposal, or the casings will have to be disposed of in an approved asbestos landfill following a burn. Residues in open detonation pits must also be disposed of. If determined to be non-hazardous, the residues in the burn pit and burn pans could be collected and disposed of in a landfill (on-site, if possible), in accordance with Federal, state, and local regulations. The area adjacent to the burn pits may contain

small pieces of propellant; therefore, this area may have to be decontaminated in accordance with RCRA regulations, especially 40 CFR Part 264, Subpart X that deals with this type of activity (23).

Further details of the effects of missile storage, conversion or elimination options on human health and safety wculd occur in site-specific environmental analyses tiered from this LEIS.

#### 4.9.4.3 Potential Mitigation

Storage of rocket motors, both short- and long-term, would be in climate-controlled structures, separated according to quantity-distance requirements to minimize any possibility of propagation of propellant fire or detonation in a storage area.

## 4.10 SOCIOECONOMICS

The analysis of potential socioeconomic impacts at this broad, programmatic level focusses on potential employment impacts that could result from the proposed action. Changes in employment resulting from treaty actions were analyzed for individual communities and regions based on the size of the employment multiplier, the level of employment diversification, and the communities' past experience with employment fluctuations.

For this analysis, the potential impact of treaty actions on many other elements of socioeconomic impacts, such as changes in demands for housing, utilities, roads, schools, police and fire protection, are taken to be roughly proportional to the employment impacts. Reduced defense employment in a given community or region would, therefore, result in a lower demand for public services, housing, and social services.

Pre-established criteria were used to differentiate employment impacts of various degrees, from highly adverse to negligible. According to these criteria, employment declines of more than ten percent would be assessed as high adverse impacts, and declines of less than one percent would be considered negligible socioeconomic consequences, with moderate to low levels of impacts occurring with employment declines of five to ten percent, and one to five percent, respectively.

The overall study approach used to analyze socioeconomic impacts included the following:

Executive Level Interviews: Personal and telephone interviews were conducted with key administrative staff to determine total manpower requirements associated with operating various bomber and missile military units. This information served as a basis for determining potential employment impacts associated with eliminating various weapon delivery systems partially, and for whole military operating units (wing, fleet, etc.). Interviews were conducted at Army facilities currently involved in missile motor elimination to determine some rough order of magnitude work force estimates associated with elimination activities. Contacts were also made at the heavy bomber storage, conversion, or elimination facilities to determine additional manpower requirements for either reclamation or conversion of bombers from nuclear to conventional bombing capabilities.

Economic Modeling: The "employment multiplier" was used as a tool for determining how a reduction of jobs on a military installation would affect jobs in the local market and surrounding region. The "employment multiplier" concept shows how a job created in the basic sector (manufacturing, defense, etc.) generates additional employment in the non-basic or support sector (retail, medical, and services) of the local economy.

Military and defense civilian employment is a basic employment industry because it brings outside money into the local economy and involves producing a good or service (national defense) that is exported outside the region. Non-basic industry employment is generally in a service-oriented sector that does not earn income from outside the region but serves the local economy. The ratio of basic to non-basic employment in a given region is the employment multiplier, indicating how many total jobs in the community would be lost or gained if defense employment was either reduced or increased.

The employment multipliers used in this analysis were derived from the employment multipliers developed by CERL in their EIFS model. The CERL multipliers were reduced by fifty percent to take into consideration the fact that local military employment does not have the full impact on the local non-basic employment sector that would be evident with other private basic industries because many goods, services, and housing are consumed on the military installation.

## 4.10.1 HEAVY BOMBER DEPLOYMENT BASES

### 4.10.1.1 Analysis Methods

Interviews with AF manpower planning personnel provided a basis for measuring approximate employment impacts associated with the potential elimination of bomber aircraft. The relationship between the number of bombers and the number of personnel supporting them is not proportional; it is "non-linear." That is, the deactivation of a single bomber at an AFB would result in a force reduction of about 25 positions. The deactivation of three bombers would result in a personnel reduction of about 125 people, and the deactivation of a squadron of fourteen bombers, along with its wing headquarters and support units, would represent a reduction in force of approximately 950 positions.

AFBs with two bomber squadrons within a wing would have slightly different increments of force reduction, with the deactivation of the first squadron of fourteen bombers representing a reduction of 540 personnel. The deactivation of the second squadron and the bomber wing headquarters could represent an additional reduction of 950 positions, which could include all wing administration personnel responsible for both squadrons, for a total of 1,490 personnel (38).

### 4.10.1.2 Potential Impacts

The potential impacts associated with the proposed action are related to the number of bombers that could be eliminated under the provisions of the Treaty and the aircraft basing strategy utilized by the AF to accommodate the requirements of the proposed action. The time allowed to make the treaty-specified bomber reductions could also heighten or lessen the economic impacts for affected communities. A shorter time frame would generally result in more severe impacts on the local economy.

The employment changes associated with removing only one or several bombers from a base would result in only minimal impacts to the local communities. To the extent that more substantial reductions would be made at one or more bases, the impacts could be significant, as described below.

In addition to the reduction in personnel directly associated with the weapon systems, there would be additional reductions in base operating support positions. Reduced local contracting for supplies and services would also reduce overall defense-generated employment and income in the primary county and in the fifty-mile region.

Among the fourteen bomber bases, the military employment multiplier for the primary county ranges from 1.4 for small communities with an employment base of 12,500 and a population of 32,000, to 2.5 for larger metropolitan markets with an employment base of 600,000 and a population exceeding 1 million. In the smaller community, the multiplier of 1.4 indicates that the loss of one bomber-related job on-base will result in an additional loss of 0.4 jobs in the local economy. The 2.5 multiplier for the larger metropolitan market would mean that the loss of one bomber-related job would result in the loss of 1.5 non-basic industry jobs. Although this potential loss of 1.5 jobs for every one directly lost seems more severe, such losses could represent only a small percentage of the larger community's employment base, resulting in inconsequential impacts on the economy.

The hypothetical elimination in one year of a fourteen-bomber squadron and wing, representing 950 bomber-related positions, would result, with the employment multiplier, in a loss of about 1,400 jobs in the smaller communities and about 2,300 jobs in the larger ones. This loss of bomber-related employment would represent a decline of only 0.4 percent in the large market, and a more significant proportion of 11.0 percent in the smaller, primary county, labor market.

At this programmatic level of analysis, employment impacts could be generally assumed to be distributed throughout a fifty-mile radius region around an installation. Alternatively, the impacts could be assumed to be essentially limited to the base's primary county. Table 4-11 presents the results of both alternative analytic assumptions. By using the primary county as a basis for determining the level of impact of a bomber squadron and wing deactivation (950 personnel), there could be one community potentially experiencing a high adverse impact, eleven communities with low adverse impacts, and two with negligible impacts. Assessing impacts distributed over a larger, fifty-mile radius region, the level of impact could be significantly less, with seven areas experiencing low adverse impacts and seven experiencing negligible adverse impacts from the proposed action.

Identifying the level and intensity of employment decline and economic impacts resulting from the deactivation of a bomber squadron would require a more detailed analysis of the commuting and labor force characteristics of the region. The primary county and 50-mile radius regional impact analysis is presented to provide a range of likely economic impacts associated with the deactivation of a 950-personnel bomber squadron and wing.

| Table 4-11<br>Potential Level of Employment Impact for Bomber Bases<br>Primary County and 50-Mile Region | | |
|---|---|---|
| **Significance Criteria** | **Number of Communities Impacted (Primary County)** | **Regional Impact (50-Mile Region)** |
| High Adverse (employment declines greater than 10%) | 1 | |
| Moderate adverse (employment declines 5% to 10%) | 0 | |
| Low adverse (employment declines 1% to 5%) | 11 | 7 |
| Negligible impacts (employment declines less than 1% annually) | 2 | 7 |
| TOTAL | 14 | 14 |

The severity of economic impacts experienced from bomber deactivation by individual communities may also depend on the time frame during which Treaty-related reductions are carried out. Deactivation occurring over a several year period would usually be less adverse to the community than would be the case for deactivation occurring in a single year.

The magnitude of declines in employment experienced by local economies and regions in the last twenty years is another factor in the significance of potential impacts. A deactivation of a squadron and wing could represent a percent employment decline greater than had previously been experienced in three of the fourteen primary counties (those including Eaker, Wurtsmith, and Grand Forks AFBs). If it were assumed that the bomber deactivation-related employment loss was distributed over the fifty-mile region, the percentage employment decline from deactivation would be less than experienced historically at the regional level (Table 4-12).

Economic impacts associated with bomber deactivation would also be intensified in communities with undiversified economies. In many cases, the community's primary county is heavily reliant on the AFB as a source of employment, accounting for more than ten percent of the primary county's employment base at eight out of 14 primary bomber base counties. Historically, undiversified economies have generally had greater difficulty in generating replacement employment opportunities from economic development efforts than is evident in economies with a more diverse economic base.

Figure 4-9 shows that twelve of the fourteen communities have per capita income levels below the national average. Several of the bases provide some of the higher paying jobs

**Table 4-12**
**Comparison of Historical Annual Employment Declines with Potential Bomber Deactivation Activities**

| | Primary County | | 50-Mile Region | |
|---|---|---|---|---|
| Bomber Bases | Historical Empl. Decline Percent Annual | Empl. Impact Bomber Deactivation Percent Annual | Historical Empl. Decline Percent Annual | Empl. Impact Bomber Deactivation Percent Annual |
| B-52 | | | | |
| Barksdale | -4.8 | -3.8 | -4.8 | -0.7 |
| Carswell | -7.3 | -0.4 | -5.5 | -0.1 |
| Castle | -4.6 | -2.1 | -4.5 | -0.7 |
| Eaker | -3.7 | -4.8 | -4.8 | -0.9 |
| Fairchild | -4.5 | -1.1 | -4.4 | -0.9 |
| Griffiss | -3.6 | -1.5 | -5.1 | -0.4 |
| Loring | -4.1 | -3.4 | -4.1 | -3.4 |
| Minot | -2.3 | -4.2 | -2.2 | -3.2 |
| KI Sawyer | -7.8 | -4.5 | -5.5 | -2.5 |
| Wurtsmith | -5.4 | -11.0 | -5.3 | -2.7 |
| B-1B | | | | |
| Ellsworth | -5.3 | -3.1 | -5.1 | -2.2 |
| Dyess | -6.9 | -2.1 | -5.5 | -1.5 |
| Grand Forks | -2.3 | -3.6 | -2.1 | -1.9 |
| McConnell | -8.0 | -0.7 | -6.0 | -0.5 |
| United States | -3.6 | | -3.6 | |

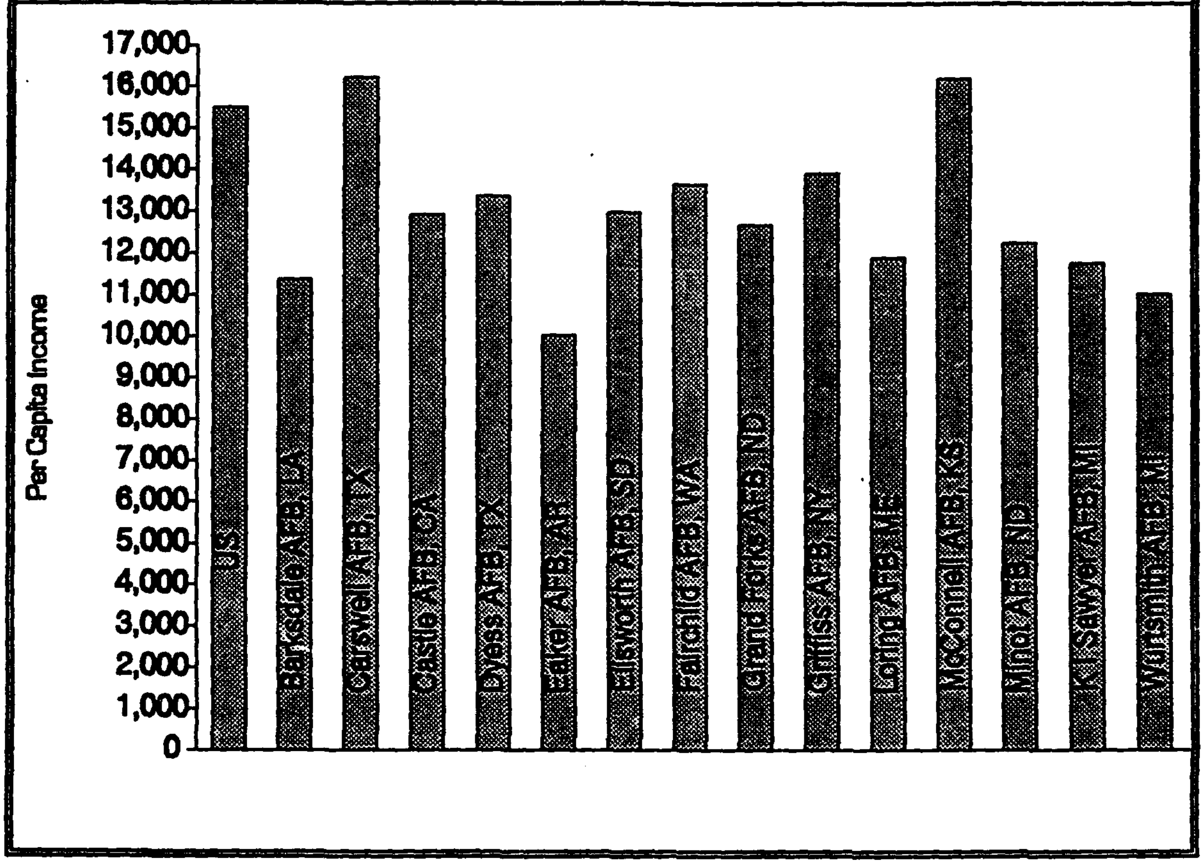
Source: CERL Economic Data Base and Labat-Anderson

in the region, and, therefore, employment impacts may be more severe than just the percent of employment figures would indicate.

#### 4.10.1.3 Potential Mitigation

Potential mitigation measures to be considered could include the integration of community impact analysis into the bomber basing strategy to allow planners and decision makers to consider the several differential impact elements, along with other essential force planning considerations. The timing for deactivation could also be scheduled to be sensitive to seasonal unemployment cycles. Bomber deployment extended over a longer period of time could also lessen the shock effect on small local economies tied significantly to the AFB bomber mission.

**Figure 4-9**
**1987 Per Capita Income**
**Primary Counties Containing Bomber Bases**




The Office of Economic Adjustment (OEA) of the Assistant Secretary of Defense was established to coordinate the resources of various federal agencies to assist communities affected by base realignment actions. The OEA efforts serve to mitigate economic impacts by assisting communities in development and implementation of a comprehensive economic recovery program. The OEA, with assistance from the President's Economic Adjustment Committee (EAC), is able to establish priority assistance to community requests for federal technical assistance, financial resources, and access to other federal programs that can provide community assistance. OEA is also available to provide impact planning grants for the development of community base-reuse plans, which allow private businesses and local governments to use base facilities for economic development purposes.

### 4.10.2 ICBM DEPLOYMENT BASES

#### 4.10.2.1 Analysis Methods

Air Force manpower planning personnel were interviewed to determine employment characteristics associated with the operation of ICBM facilities. Typically an AFB has one wing with 150 missiles distributed among three squadrons with fifty missiles each. The squadron consists of five flights with ten missiles, and one LCF assigned to each flight.

The number of personnel required to operate a single squadron of fifty missiles is approximately 300 military personnel. Deactivation of the total wing and three squadrons responsible for the 150 missiles could result in a reduction of 1,700 positions. If the deactivation were conducted over an assumed three year period of time, the reduction levels could occur in increments of 300 personnel for the first squadron, 500 personnel for the second squadron, and 900 for the final squadron, which could include all of the wing level administrative personnel, for a total reduction of 1,700.

Under current estimates, the removal of the ICBMs could safely be accomplished at a rate of one per week, or fifty per year, with an estimated three-year period for the elimination of 150 missiles. The civilian on-site construction employment required to remove and deactivate an ICBM is broken down among a silo-stripping crew, demolition team, and a site clean-up/grading crew that may prepare the site for Soviet verification. The ICBM deactivation construction activity could employ a total of ten to fifteen construction workers full time, over a three-year period (14).

#### 4.10.2.2 Potential Impacts

The potential impacts associated with the ICBM launcher elimination would be related to the number of launchers involved in the proposed action, and the missile basing strategy that may be used by the AF to accommodate the proposed action. The time frame allowed for in the Treaty would also influence the level and intensity of economic impacts that could be experienced.

Among the six ICBM communities, the military employment multipliers for the primary counties range from 1.4 for small communities with an employment base of 20,600, to 1.7 for the largest community with an employment base of 53,000. If an entire three-squadron wing (representing 1,700 personnel) were deactivated in a three-year period, this could result in a total direct and indirect employment impact in the smallest community of approximately 2,300, and in a large community it could total about 3,000 jobs.

As shown in Table 4-13, by using the primary county as a basis for assessing the level of impact of a missile wing deactivation, all six areas could experience comparable low adverse impacts, with employment declines between one-to-five percent annually.

Assuming the impacts may be distributed over a larger fifty-mile radius region, the level of impact could be significantly less with only two locations experiencing low adverse impacts, and four locations experiencing negligible adverse impacts from the proposed action, with employment declines of less than one percent annually.

**Table 4-13**
**Potential Levels of Employment Impacts for ICBM Bases**
**Primary County and 50-Mile Region**

| Significance Criteria* | Number of Communities Impacted (primary County) | Regional Impact (50-mile region) |
|---|---|---|
| High adverse (employment declines greater than 10% | | |
| Moderate adverse (employment declines 5% to 10%) | | |
| Low adverse (employment declines 1% to 5%) | 6 | 2 |
| Negligible impacts (employment declines less than 1% annually) | 0 | 4 |
| TOTAL | 6 | 6 |

*Assumes three-year deactivation period

The level and intensity of employment decline and economic impacts resulting from the deactivation of a ICBM missile wing would require a more detailed analysis of the commuting and labor force characteristics of the region. The primary county and fifty-mile radius regional impact analysis is presented to provide a range of likely economic impacts associated with the deactivation of a 1,700 personnel missile wing.

Similar to the bomber bases, the ICBM community's experience with employment declines in the past twenty years is another factor influencing the significance of the impacts. A missile wing deactivation could result in an employment decline higher than previously experienced in only Minot AFB's primary county, where a missile wing deactivation could create an annual employment loss of 2.5 percent against a maximum historic decline of only 2.3 percent during the 1969-1987 period. On a regional basis, reductions would not exceed previous 1969-1987 single year downward employment fluctuations at any base (Table 4-14).

Moreover, in five of the six communities, the AFB accounts for ten percent, or more, of the total primary county employment. This makes these communities less readily capable of replacing military-related job losses with new jobs in other sectors. The six locations also generally exhibit lower per capita income levels with all six primary counties having incomes of at least ten percent below the national average (Figure 4-10).

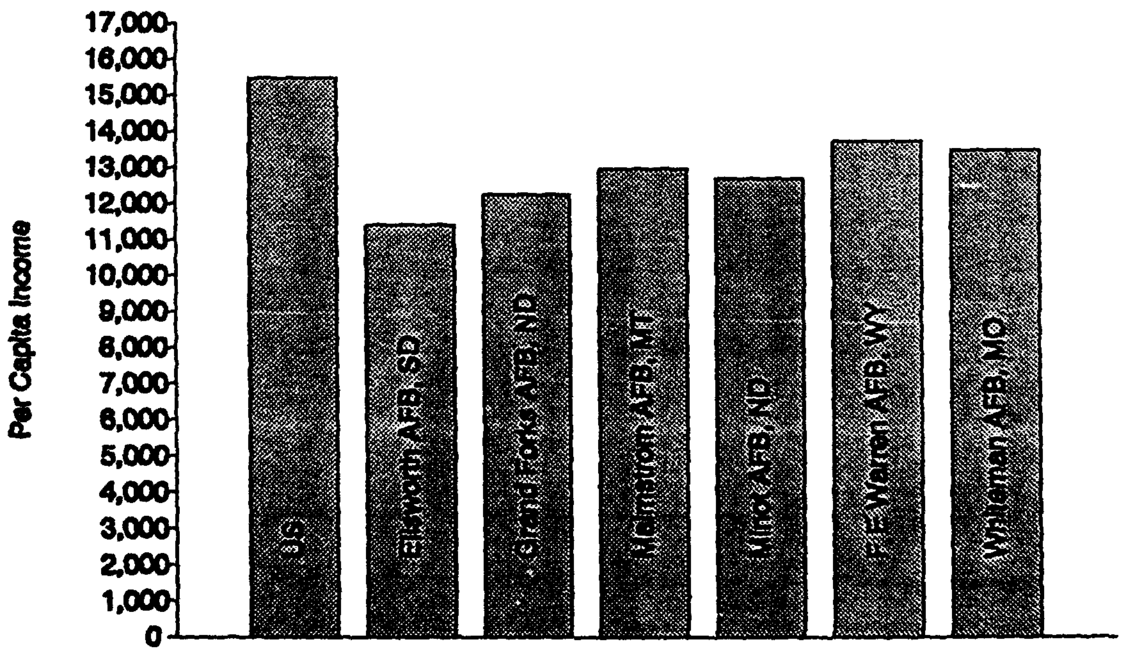
**Table 4-14**
**Comparison of Historical Annual Employment Declines with ICBM Deactivation Activities**

| | Primary County | | 50-Mile Region | |
|---|---|---|---|---|
| ICBM Bases | Historical Empl. Decline Percent Annual | Empl. Impact ICBM Deactivation Percent Annual[1] | Historical Empl. Decline Percent Annual | Empl. Impact ICBM Deactivation Percent Annual |
| Ellsworth | -5.3 | -1.9 | -5.1 | -1.3 |
| Grand Forks | -2.3 | -2.1 | -2.1 | -1.1 |
| Malmstrom | -3.8 | -2.3 | -3.6 | -2.0 |
| Minot | -2.3 | -2.5 | -2.2 | -1.9 |
| Warren | -4.8 | -2.0 | -3.0 | -0.7 |
| Whiteman | -6.8 | -3.8 | -3.3 | -0.7 |

[1] Assumes three-year period to deactivate 150 missile wing

Source: CERL Economic Data Base and LAI, Inc.

**Figure 4-10**
**1987 Per Capita Income**
**Primary Counties Containing ICBM Bases**

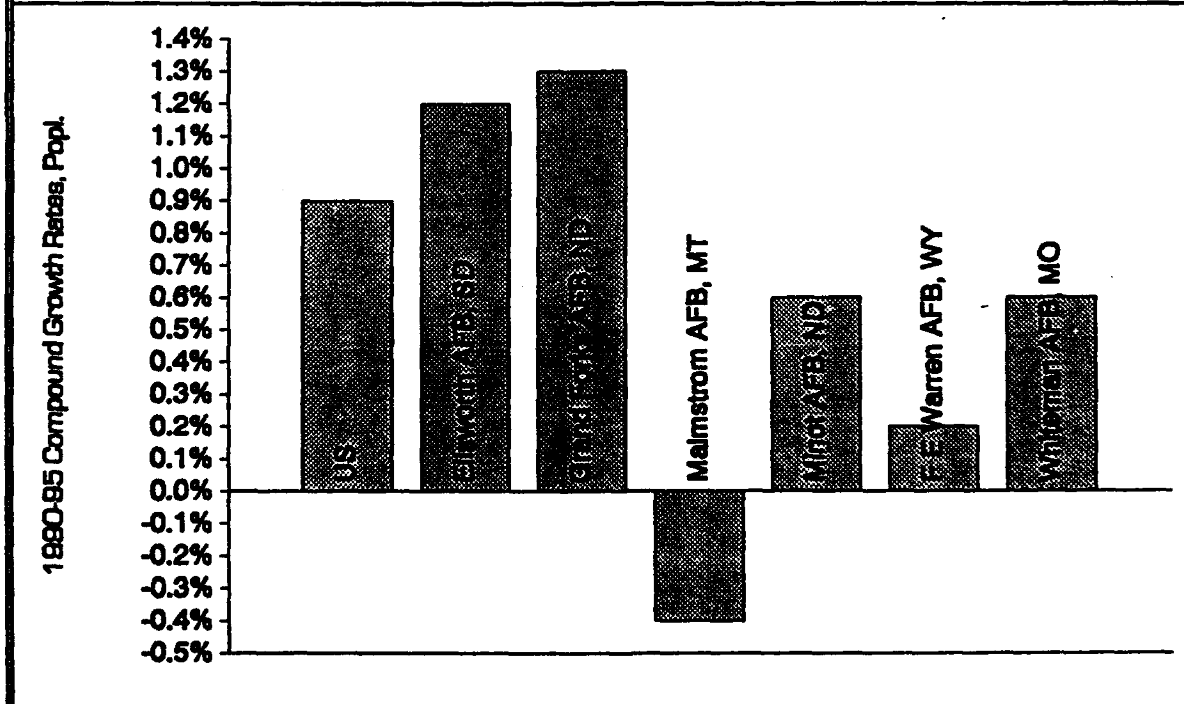


The locations being in more remote lower income areas also tends to make government civilian employment some of the highest paying jobs in the region. The loss of these higher paying jobs may have even more significant impacts on smaller markets.

The return of the several acres of missile silos and road access land to agricultural, open space or other land use could have a positive but regionally negligible effect on productivity. The deactivation of 150 silos could result in the return of approximately 300 acres to a non-military productive use.

Only one of the six ICBM communities (Malmstrom AFB) is forecasted to experience a population decline in the primary county during the 1990-1995 period (Figure 4-11). This forecast assumes no missile wing deactivation activities, and the impact of deactivation could further intensify the declining population trend for this community. The other five communities are expected to experience slight population increases over the next five years, which could be lessened by any declines in military related employment resulting from the proposed action.

**Figure 4-11**
**1990-1995 Forecast Population Change in U.S. and Primary Counties Containing ICBM Bases**



#### 4.10.2.3 Potential Mitigation

Potential mitigation measures could include the integration of community impact analysis into the missile basing strategy to allow deactivation to occur in communities that are less dependent on the military. The timing for deactivation could also be scheduled to be sensitive to seasonal unemployment cycles. Missile deployment extended over a longer period of time could also lessen the shock effect on small, local economies tied significantly to the missile program.

The OEA is available to mitigate economic impacts by assisting communities in development and implementation of a comprehensive economic recovery program. The OEA, with assistance from the EAC, is able to establish priority assistance to community requests for federal technical assistance, financial resources, and access to other federal programs that can provide community assistance. The OEA is also available to provide impact planning grants for the development of community base-reuse plans, which allow private businesses and local governments to use base facilities for economic development purposes.

### 4.10.3 HEAVY BOMBER STORAGE, CONVERSION, OR ELIMINATION FACILITIES

#### 4.10.3.1 Analysis Methods

Key administrative and planning staff were contacted at Tinker AFB and at the Davis-Monthan AFB AMARC facility to determine current manpower requirements and facility capabilities. The AMARC facility is a potential location for eliminating bombers through storage or physically destroying the wings, tails, and fuselage of the bomber. The Tinker AFB maintenance facility could perform the necessary work for converting the aircraft from nuclear to conventional bomber capabilities with Kelly AFB possibly assisting in routine maintenance operations.

#### 4.10.3.2 Potential Impacts

Potential socioeconomic impacts associated with bomber aircraft storage, conversion, or elimination are expected to be positive for the local economy, resulting in a slight increase in employment and income.

The Davis-Monthan AMARC operation currently employs a staff of approximately 650 people, who are capable of stripping and preparing an average of 325 aircraft annually for outside storage. An estimated twenty crane operators, fork lift operators, and aviation mechanics could be required to handle additional bomber aircraft that may be eliminated. The local labor force can very easily supply these skilled personnel from a fairly large number of retired AF people living in the surrounding region. An estimated construction

budget of $4 million is also anticipated for building an additional aircraft nose-dock, and for construction of facilities required for Soviet verification procedures.

Tinker and Kelly AFBs currently estimate their existing personnel are capable of handling the proposed action-conversion requirements. It is anticipated that manpower currently scheduled for upgrading and reconditioning the B-52s could be redirected to treaty-driven activities associated with converting B-52s from nuclear to conventional capabilities with an approximate equal resource commitment. Detailed manpower studies would be necessary to determine if additional manpower needs would be required to implement the Treaty plan.

#### 4.10.3.3 Potential Mitigation

Mitigation measures would not be required for the anticipated beneficial impacts associated with the bomber storage, conversion, or elimination.

### 4.10.4 MISSILE STORAGE, CONVERSION, OR ELIMINATION FACILITIES

#### 4.10.4.1 Analysis Methods

Among the missile motor storage, conversion, or elimination facilities, Pueblo and Longhorn facilities have had several years of experience with static firing and open detonation of Pershing missile motors, as required by the INF Treaty. This past experience with missile motor elimination serves as a basis for analyzing potential socioeconomic impacts associated with the proposed action.

#### 4.10.4.2 Potential Impacts

Missile motor elimination activities carried out at one or more of the facilities could have a slight positive impact on the local economy's employment level and income base. It is estimated, based on manpower requirements for similar Pershing missile motor elimination, that a team of between fifteen and twenty full time personnel would be required to conduct the elimination activities.

A ten-person Soviet verification team would also be present for elimination activities. This team would be living in a local motel and could be present approximately three-fourths of the time at the facility, assuming verification procedures are similar to the INF Treaty requirements.

Expenditures associated with the hotel, meals, and local purchases by the Soviet verification team could also have a small positive impact on income and jobs in the local economy. Historically, Soviet verification team activities have had only positive socioeconomic effects on the local communities.

With either storage, conversion, or elimination, construction of new facilities may be required. The socioeconomic impacts associated with this new construction would be short-term and beneficial to local communities supplying the labor force and materials. The extent of the impacts may depend on the amount of construction and would need to be analyzed on a site-specific basis.

This analysis of minimum, beneficial economic impacts, and no adverse socioeconomic impacts, also generically applies to potential portal perimeter verification monitoring facilities and activities.

#### 4.10.4.3 Potential Mitigation

If missile elimination sites are selected in communities that have had no previous experience with Soviet verification teams, additional training of military and civilian personnel and enhanced communication regarding the Soviet team's schedule and location within the community involved may be appropriate. The On-Site Inspection Agency's experience in working with Soviet verification teams with the INF Treaty has provided established procedures and protocol for working with Soviets that may be applied to the proposed action and the verification process.

## 4.11 CUMULATIVE IMPACTS

This section discusses the potential impact on the environment which could result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. The potential individual impacts resulting from the proposed action or other actions may be insignificant, but collectively they may pose a significant impact. This document is programmatic and therefore, discusses cumulative impacts in a generic sense by resource element. Full analysis of additive, cumulative impacts of the proposed action, and cumulative impacts caused by unrelated actions with the proposed action, would be addressed on a site-specific basis in subsequent tiers of NEPA documentation.

### 4.11.1 AIR QUALITY

The spacing and timing of potential burning activities must be considered in the evaluation of potential additive, cumulative impacts to air quality, as well as the potential unrelated additive effect of burning activities not related to the proposed action. Coordination of activities would prevent unanticipated accumulation of emissions.

A cumulative impact to air quality would occur if the proposed action alters the level of support operations at potentially affected bases in conjunction with other mission-related changes. A long-term reduction in operations would benefit local air quality by reducing both mobile and stationary source emissions generated by support operations. The level of significance of these potential cumulative impacts would be dependent on the number of bombers and missiles to be scheduled for storage, conversion, or elimination. Short-term cumulative impacts to air quality would occur at the storage, conversion, or elimination facilities if new construction is required and other similar pollutant-emitting activities are taking place in the close vicinity. The level of significance of this short-term impact would be dependent on the magnitude of the construction project but must be analyzed at the specific locations. Operational emissions of any new facilities would add to the emissions produced by unrelated actions in the same air basin, having a cumulative effect on air quality.

Burning or launching solid rocket motors and subsequent release of HCL emissions would contribute to the problem of acid rain and ozone depletion. While the cumulative impacts stemming from acid rain formation could be significant at the local level, the national and global impacts are expected to be negligible. Ozone depletion would be insignificant at the local, national, and global levels.

Based on a report submitted to Congress in September 1990 titled "Recent State of Knowledge of the Upper Atmosphere 1990: An Assessment Report" by R.T. Watson, et al. (11), most inorganic chlorine species such as HCL are soluble and therefor removed rapidly in the troposphere by rainfall and other processes. Because most of the HCL from

any rocket motors launched for research and development and commercial purposes and all the HCL from static fire or open-detonated motors would be released below fifteen km, no significant cumulative effects on stratospheric ozone are expected.

Aluminum oxide has the potential to enhance ozone destruction in the lower stratosphere although the exact role of particulates from the solid rocket motors in the chemistry of the stratosphere is not well characterized today. Launch for research and development or commercial purposes could emit insignificant amounts of $AL_2O_3$ above fifteen km and most aluminum particulates greater than one micron emitted from static fire or open detonation would quickly settle out of the troposphere to the earth's surface (11).

The potential incremental effect of chlorine emissions to the stratosphere must be considered. The launch of 950 MM 1st, 2nd, and 3rd stage motors in one year (worst case) would release approximately 1.678 kilotons of chlorine into the stratosphere (assuming 37% of total chlorine enters the stratosphere). The estimated annual source of stratospheric chlorine from industrial halocarbons is about 300 kilotons (11). The total amount of chlorine released into the stratosphere from nine Space Shuttle and six Titan launches is approximately .725 Kilotons (11). Thus, the launch of the 950 MM motors in one year would add about .56% to the current stratospheric sources of chlorine. The change in yearly average global total ozone from the nine Space Shuttle and six Titan launches is a decrease of .0065% (8). The additional change in average global total ozone from the launch of 950 MM motors in one year could be a decrease of approximately .015%, assuming a decrease proportional to that caused by Space Shuttle and Titan launches. The location of the launches, rate of mixing between the troposphere and the stratosphere, and the launch path are factors that would cause deviation from this .015% figure. The .56% increase in stratospheric chlorine would represent a short-term, minor increase that would be insignificant in itself, but could be considered significant due to incremental effects on stratospheric ozone depletion caused by numerous, individually insignificant sources.

The launch of MM rocket motors for research and development and commercial purposes, if implemented as a method of reducing the inventory of retired boosters, would likely involve infrequent launches of a small percentage of the 950 rocket motors. Because of aging and reliability concerns, some of the rocket motors might not be convertible to launch capacity. Thus, the cumulative impacts of the launch method of elimination would likely be insignificant.

The accumulation of HCL in the troposphere from static firing, open detonation, or launch for research and development and commercial purposes could significantly lower the pH of local rainfall surrounding elimination facilities, especially if the facilities are near any industrial or transportation sources emitting other acid rain causing substances such as oxides of sulfur or nitrogen. The magnitude of the potential cumulative effects of HCL emissions would depend on rate of burn or launch activity, the proximity of other sources emitting acid rain producing substances, and the local meteorological conditions.

Receptors downwind of the open detonation and static fire facilities could experience health impacts. If multiple rocket motors are burned at the same site under essentially the same meteorological conditions, then persons living downwind would receive multiple exposures that would be cumulative. This potential cumulative effect must be analyzed further in follow-on documents.

### 4.11.2 NOISE

Cumulative noise impacts could occur from the proposed action. The spacing and timing of potential silo blasting activities would influence the level of noise disturbance. The same is true at missile elimination sites. If multiple motors are fired at the same time, the $L_{dn}$ level would be significantly higher than if just one motor were fired.

As was the case with air quality, cumulative noise impacts may originate from reduced support operations at bases, construction activity, and/or operational activities at storage, conversion, or elimination facilities. When unrelated actions in the vicinity are added to these Treaty-driven impacts, cumulative impacts are possible. Depending on the nature of the actions and subsequent reductions or increases in noise levels, the impacts could be considered beneficial or adverse. The proximity of both noise-sensitive receptors and other ongoing noise-producing events or areas (i.e., metropolitan areas) influences the degree of potential benefit or adversity which must be analyzed at the specific locations.

### 4.11.3 WATER RESOURCES

Cumulative adverse impacts could occur to water resources from the explosive demolition associated with the destruction of missile silos. The number of explosives within a given area would determine the magnitude of impact. Potential cumulative effects include altered flow regime of surface and ground water and groundwater contamination. Altered flow regime would be prevalent in areas characterized by karst topography. A karst topographic area consists of sinkholes, caverns, and diversion of surface water to subterranean waters. The explosive blasts could fracture limestone in the karst areas. These fractures could be eroded by ground or surface waters leading to the formation of additional sinkholes and caverns and altered flow regime. Karst terrain is prevalent in Missouri, and karst aquifers may be present in the Whiteman AFB deployment area. The blasting of one silo in the area may not significantly alter flow, but blasting 150 silos could result in significant alteration of surface and ground water flows.

Blasting the top 25 feet of the silo would likely cause fractures in the lower portions of the silo. Surface water may infiltrate through the upper portion of the silo and exit the lower fractured portion of the silo carrying potential contaminants such as lead, PCB,s, or asbestos from the interior of the silo. Another possible source of reduced water quality could originate from ground water entering and exiting any portion of the fractured or demolished portions of the silo. Potable ground water could enter through the fractures, become contaminated, and subsequently contaminate the surrounding groundwater after

exiting the silo. Again, blasting one silo in an area may have an insignificant effect on ground water quality while blasting 150 silos could lead to significant degradation of ground water quality.

Determination of missile deployment areas containing aquifers in areas characterized by karst topography, and a more precise estimate of likelihood and extent of possible contamination would follow from site-specific analysis of the missile deployment areas.

Reduced support operations at bases, new construction activity, and/or operational activities at storage, conversion, or elimination facilities in conjunction with other unrelated actions would cumulatively impact water resources. Reduced support operations would likely result in a beneficial impact to water usage. Unrelated actions may be able to take advantage of the reduced demand or may accentuate reduced consumption. New construction would increase sediment loads in nearby drainages during initial grading and excavating and cause greater runoff from non-permeable surfaces once construction is complete. The number and magnitude of unrelated construction activity in the vicinity of potential Treaty-generated construction would influence the degree of adversity of this cumulative impact. More operational activity at the storage, conversion, or elimination facilities would increase consumption of water from any local or regional aquifers and potentially add to the cumulative drawdown of those aquifers. Additionally, these support operations would add to the quantity of wastewater generated in the area, as well as increase the chances for ground and surface water contamination due to fuel or other chemical spills and $Al_2O_3$ and HCl deposition at burning sites. The nature of these and other actions, and surrounding water resource characteristics, influence the potential for beneficial or adverse impacts which would need to be addressed on a site-specific basis.

### 4.11.4 GEOLOGY/SOILS

The destruction of missile silos by explosive detonation could have an adverse cumulative impact on earth resources. One blast may have a minimal impact on the geology and soil resources, but the blasting of, for example, 150 silos in a one- or two-county region could result in a significant, cumulative impact. Damage to the local and regional geology and soil structure may lead to ground subsidence and other surficial hazards. There could also be a greater cumulative geology/soils impact associated with the blast-destruction of ICBM silos at Ellsworth AFB because the soils have a high shrink-swell potential and are susceptible to slumping.

Construction of new support facilities to support the proposed action would add to the degradation or disruption of surface soils in an area. This cumulative impact may be short-term and negligible, assuming use of erosion control techniques and proper revegetation practices. Static firing or open burning of missile motors may add to the soil accumulation of $Al_2O_3$ and HCl, but with no significant effects on biota. Bomber storage and conversion facilities may be more likely to experience soil contamination due to increased use and disposal of hazardous wastes and the potential for fuel spills. The

level of activity above existing activity would influence the potential for accidental spills and subsequent soil contamination. Once the level of activity is defined, the number of specific types of deployed weapons chosen for reduction, and the extent of acitivity at identified and other potential locations known, more conclusive, site-specific analysis may be initiated.

### 4.11.5 CULTURAL RESOURCES

Cumulative impacts on cultural resources would occur if elimination of all silos in a flight, or construction, expansion, or modification activity results in the destruction of all significant resources in the area, or all resources of a particular type. If demolition of one silo impacts a portion of a resource, but when added to the demolition of other silos, a larger portion of the resource is destroyed, a cumulative impact would be expected. The same is true for any construction, expansion, or modification activity and burning and firing of rocket motors. Cumulative impacts to cultural resources are also possible when other actions occurring within the deployment sites or storage, conversion, or elimination facilities are added to the proposed action; however, this would need to be addressed on a site-specific basis.

### 4.11.6 VISUAL RESOURCES

Cumulative impacts on the visual resources are the additive effects occurring within a single view, or a set of closely related views. If dismantling of all silos in a flight results in noticeable physical changes to the resource, a cumulative impact would occur. Because the silos are geographically dispersed, this is not expected to occur. A cumulative impact would also occur if the plume formation from one motor impacts a portion of the visual resource, but when added to the plumes from the destruction of other motors, a larger portion of the resource is affected. Cumulative impacts to the visual landscape are also possible when other unrelated actions occurring within the same view are added to the proposed action; however, the significance of this and other potential impacts would need to be addressed on a site-specific basis.

### 4.11.7 TRANSPORTATION

Because of the length of time that could be agreed upon in the Treaty to reach launcher and warhead levels, significant additive, cumulative impacts to the transportation network from the proposed action are not expected.

Cumulative impacts on the transportation network would occur if aircraft withdrawals, base closure/realignment, or mission changes occur at the deployment bases, in addition to the likely missile deactivation activities at these bases. The level of activity generated at the bomber and missile storage, conversion, or elimination facilities from activity outside of the proposed action, combined with activity generated from the proposed action, comprise the conditions for potential cumulative adverse impacts to the air, rail, and roadway

transportation networks. These cumulative impacts would have adverse effects on roadway level of service; air, rail, and roadway safety; noise; and emissions. Problems could arise in obtaining missile transportation equipment for START activities if other non-related activities using the same limited supply of equipment are on-going.

### 4.11.8 BIOLOGY

Cumulative impacts could occur from the proposed action at the bomber and missile deployment sites and storage, conversion, or elimination sites. The cumulative nature of additive project impacts is a function of quantity and level of activity within a defined geographic area. For example, the demolition of one silo could have negligible impacts to the biological resource, but if all silos in a flight were destroyed within the same time frame, the result would cause a greater disturbance. Similarly, static firing or open detonation of ten missile motors at one time in the same area, as opposed to static firing or open detonation of the ten missiles over a one-week period, would determine the level of impact to the biota in the area. The level of significance of beneficial cumulative impacts to biological resources at bomber deployment bases would be dependent on the number of planes removed from a base and the duration of any decreased low-level flight and weapon-range activity.

Considering the proposed action with other, unrelated actions occurring in the same general locality could also result in a cumulative impact. Depending on the nature of these other actions, the impact could be beneficial or adverse, and would have to be verified at the next level of analysis.

### 4.11.9 HUMAN HEALTH AND SAFETY

The number of missiles open-detonated or static-fired within a specified time-frame would influence the degree of potential harm to nearby receptors caused by emission products and noise. The level of activity would determine the potential for additive short-term occupational and health impacts to workers at the bomber and missile storage, conversion, or elimination facilities.

A cumulative impact to human health and safety would occur if the proposed action alters the level of support operations at potentially affected bases in conjunction with other mission changes. A long-term reduction in operations would reduce the amount of hazardous and other waste generated at a base resulting in a beneficial impact.

Considering the proposed action with other unrelated actions occurring in the same general locality could result in additional cumulative impacts. Depending on the nature of these other actions, the impact could be beneficial or adverse and would have to be verified at the next level of analysis.

### 4.11.10 SOCIOECONOMICS

Basing and force structure changes resulting from the proposed action would not occur in isolation. Other changes may also occur during the 1990s which could to some degree add to or cancel out the effects resulting from the proposed action. These other potential changes, if any, are issues not ready for decisions, and are beyond the scope of this study.

Three of the bomber bases also support ICBMs. These bases could experience impacts from reductions in both systems. Such cumulative employment decreases would be greater than the sum of each system's reductions because general base support functions needed by either or both missions could perhaps also be reduced. No quantifiable data on this possibility was available for this study. Two of the ICBM bases are in the same state, which may lead to a possibility of an additive effect to that state if both bases are affected.

Cumulative impacts could also result from bomber deployment actions if a base selected for major bomber reductions is also located in a community that is heavily dependent on defense contractors. The scheduled defense budget reductions could simultaneously impact defense contractors and subcontractors that are located in the same regional economy, thus causing a cumulative impact on the regional economy. Changing defense needs could also result in a decline in business currently located in the six ICBM candidate communities.

Even in the absence of DOD-related changes, three of the bomber bases' (Eaker, Griffiss, and Loring AFBs) primary counties have populations that are projected to decline between 1990-1995, primarily due to current and likely future limited employment opportunities. A decrease in employment caused by bomber deactivation actions could likely exacerbate these declines.

A declining population can, but does not always, cause problems for a community and its ability to fund and provide services to its residents. Detailed exploration of the potential significance of this situation is reserved for future, more site-specific analyses, if appropriate.

Only one of the six ICBM locations (Malmstrom AFB) is forecasted to experience a population decline in the primary county during the 1990-1995 period. This forecast assumes no missile wing deactivation activities, and the impact of deactivation could further intensify the declining population trend for this community. The other five communities are expected to experience slight population increases over the next five years, which would tend to be lessened by any declines in military related employment resulting from the proposed action.

Reduction of bombers could, unavoidably, reduce some number of DOD positions, but the number would depend not only on how much of a reduction is accomplished, but also on how that reduction were allocated among the existing bomber units and bases.

There are no significant cumulative socioeconomic effects anticipated with missile motor elimination activities.

## 4.12 UNAVOIDABLE IMPACTS

In accordance with Section 102(C)(ii) of NEPA, this discussion of unavoidable impacts considers any adverse environmental effects which cannot be avoided should the proposed action be implemented. Unavoidable impacts to various resources have been identified at the ICBM deployment bases; the heavy bomber storage, conversion, and elimination facilities; and missile storage, conversion, and elimination facilities. Table 4-15 provides a summary of the potential, unavoidable adverse impacts at these locations. Environmental impacts for bomber deployment bases are going to be beneficial with the exception of long-term unavoidable impacts of potential decreased employment.

**Table 4-15**
**Potential Unavoidable Adverse Impacts**

| Resource Area | ICBM Deployment Bases | | Heavy Bomber Storage, Conversion or Elimination Facilities | | Missile Storage, Conversion, or Elimination Facilities | |
|---|---|---|---|---|---|---|
| | Short-term | Long-term | Short-term | Long-term | Short-term | Long-term |
| Air | X | | X | X | | |
| Noise | X | | X | | | |
| Water | | X | | | | |
| Geology/Soils | X | | X | | X | |
| Cultural | | X | | X | | X |
| Visual | | | | X | X | |
| Transportation | | | | | | |
| Biology | X | | X | | X | |
| Human Health & Safety | | | X | | | X |
| Socioeconomics | | X | | | | |

### 4.12.1 ICBM DEPLOYMENT BASES

Air, noise, water resources, geology/soils, cultural, visual, biological, human health and safety, and socioeconomic resources at the ICBM deployment bases could experience adverse unavoidable impacts should the Treaty be ratified. Short-term unavoidable impacts including construction-related emissions, increased noise levels, acoustic disturbance of rock and unvegetated soils on slopes and ridges, erosion from removal of the communication cable between silos, disruption or disturbance to threatened and

endangered animal and plant species, and/or their habitat, decreased reproductive success of some animal species caused by the noise from blasting, and disruption to local vegetation could occur at the ICBM deployment bases. These short-term unavoidable adverse impacts may be seen as a trade-off for the long-term environmental gain associated with missile and launcher elimination.

Long-term unavoidable impacts could include permanent damage to sections of the local or regional aquifers caused by blasting of the silos. Long-term drawdown of water levels in the blasted areas of the aquifer could occur as well as long-term changes in the aquifer's flow regime and overall water quality. Additionally, ground disturbance activities may unavoidably affect cultural resources that have gone previously undetected. Long-term employment impacts associated with missile deactivation activities at one or all of the existing missile bases may also be unavoidable.

### 4.12.2 HEAVY BOMBER STORAGE, CONVERSION, OR ELIMINATION FACILITIES

Air, noise, geology/soils, cultural, visual, biological, and human health and safety resource areas at the heavy bomber storage, conversion, or elimination facilities would experience potentially adverse, unavoidable impacts, should the Treaty be ratified. Unavoidable short-term impacts would include increased noise levels from aircraft operations at any or all of the sites and from potential construction of new facilities at Davis-Monthan AFB. Increased aircraft emissions would potentially occur in the vicinity of these sites. If aircraft are stored at Davis-Monthan AFB, baseline activities would increase because of additional assets in caretaker status and the increased size of the storage area. This increase in baseline activities would likely generate additional stationary source emissions, resulting in an unavoidable impact to air quality. Unavoidable soil disturbance in the vicinity of Davis-Monthan AFB could occur, resulting in a greater likelihood of erosion and/or increased level of fugitive dust. A increased potential for air traffic accidents may develop due to more operations in the vicinity of Davis Monthan, Tinker, and/or Kelly AFBs. Potential short-term unavoidable impacts to biological resources would include disruption of threatened and endangered species and their habitat at Davis-Monthan AFB due to storage of heavy bombers and the construction of additional support facilities on currently unoccupied, undisturbed areas.

Long-term unavoidable impacts at the bomber storage, conversion, or elimination facilities could include ground disturbance activities at Davis-Monthan AFB that may affect cultural resources that have gone previously undetected should new facilities be constructed. The indirect loss of cultural resources due to collection and vandalism could occur in the event new facilities are constructed, and such cultural resources exist. Additionally, long-term unavoidable visual impacts would occur at Davis-Monthan AFB due to the storage of heavy bombers in currently unoccupied open fields.

### 4.12.3 MISSILE STORAGE, CONVERSION, OR ELIMINATION FACILITIES

Geology/soils, biological, visual, and cultural, and human health and safety resource areas at the missile storage, conversion, or elimination sites would likely experience adverse unavoidable impacts should START be ratified. Short-term unavoidable impacts would occur to geology and soils at missile motor elimination sites if new firing areas are constructed, resulting in disturbance to several dozen acres. The impact would be short-term, provided the area is restored to its original state after elimination is complete. The land disturbance would consist of some excavation for foundation construction, as well as grading of existing topographic features for access roads and support facilities. The construction of new open detonation pits and necessary roads would also disturb several dozen acres. This disturbance may impact biological resources in the areas of construction. These new firing and open detonation facilities would deter from the aesthetic quality of the existing landscape.

Long-term unavoidable impacts may be incurred if new storage facilities for missile motors are constructed. These facilities could unavoidably deter the aesthetic quality of the existing landscape. Similar cultural resource unavoidable impacts could occur as those mentioned for the bomber storage site in Section 4.12.2 as a result of new construction at the missile motor storage, conversion, or elimination facilities. Additional potential long-term unavoidable impacts could occur to human health and safety due to the possible generation of hazardous waste from a static fire or open detonation. Following a detonation, the motor case with remaining asbestos and residues, if determined to be hazardous, would require proper disposal in a RCRA-permitted hazardous waste landfill in accordance with any other applicable Federal, state, or local regulations.

## 4.13 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

In accordance with Section 102(C)(v) of NEPA, this section describes the major permanent commitments of resources which can be identified at this programmatic level of analysis. The Treaty program of actions could involve the following commitments of resources, should the proposed action be implemented.

Construction of facilities such as missile storage igloos, missile motor elimination facilities, and portal perimeter monitoring stations involves essentially permanent commitment of the construction materials. At this time, no unusual construction material requirements can be identified either as to type or quantity. Therefore, any construction required by the Treaty would likely require the permanent commitment of ordinary construction materials, such as steel and concrete in amounts that would be an extremely small, but presently unspecified, percentage of the local annual consumption of such resources.

Consumption of energy resources for transporting weapon systems from operational bases to storage, conversion, or elimination facilities cannot be predicted at this time, but is unlikely to represent an increase over amounts currently consumed for operation and maintenance of those systems.

Energy resources in the form of missile solid propellant could also be consumed, if missiles motors were eliminated by burning. Each pound of propellant is equivalent in energy content to roughly 0.216 tons of coal. Burning a 32-ton MM missile could be equivalent in heat release to burning about seven tons of coal. The US consumes about 900 million tons of coal annually.

Energy could also be consumed if missiles were washed out, followed either by propellant reclamation or incineration. No quantifiable prediction is available at this time as to the amounts of energy required, nor its comparability to the energy consumed in burning the missiles.

There is a possibility that water resources could be essentially permanently "lost" through localized disruption of aquifers at the sites of silo destruction (see Section 4.11.3).

## 4.14 RELATIONSHIP BETWEEN SHORT-TERM USES OF RESOURCES AND MAINTENANCE OF LONG-TERM PRODUCTIVITY

Several of the possible actions conducted to implement the Treaty could result in short-term, adverse environmental impacts that could influence maintenance and enhancement of long-term productivity. Other actions may result in long-term beneficial impacts. Beneficial impacts would include reduced risks to workers and the public who might be affected by a missile transportation accident during maintenance operations, decreased potential for worker and public exposure to hazardous substances, decreased air and noise emissions if heavy bombers are stored at Davis-Monthan AFB, and decreased water consumption and wastewater generation.

Typical types of activities which represent short-term resource uses that compromise long-term productivity are the filling of wetlands or loss of other especially important habitats, conversion of prime or unique farmlands to non-agricultural use, and consumptive use of high quality water at a non-renewable rate. Resources potentially affected by actions conducted to implement the Treaty follow.

- Short-term use of the atmosphere as a sink for the emissions products from open detonation, static firing, or launching would have an incremental effect on long-term global atmospheric condition. Such an effect, if any, is expected to be minimal compared to potential effects of current industrial emissions (10).

- Construction of any new facilities; explosive demolition of launch facility headworks; and elimination of rocket motors by static fire, open detonation, or launching would result in short-duration noise impacts. No long-term noise impacts are anticipated; therefore, no effects on the maintenance and enhancement of long-term productivity would occur.

- Explosive demolition of launch facility headworks could alter ground water flow and quality. Deposition of emission products from activities at the deployment or elimination areas, especially $AL_2O_3$ and HCL from static firing, open detonation, or launching, would have an adverse incremental impact on both surface water and ground water chemistry. For most areas with adequate pH buffering capacity (see Section 4.3.4.2), the impact to water from plume deposition would be negligible. Any decline in ground water levels or reduction in surface or ground water quality would likely make potable water more difficult and expensive to acquire. To the extent that these conditions occur, long-term productivity would be expected to decline.

- Short-term impacts to soils would be primarily related to construction of any new facilities. However, the additional loss of soil due to erosion is not expected to significantly affect long-term productivity. The deposition of emission products,

especially $AL_2O_3$ and HCL, could have an incremental effect on soil conditions, but due to the buffering capacity and alkalinity of the soils near potential elimination facilities, any effects are expected to be minimal.

- Explosive demolition of the headworks of the launchers could cause long-term geologic impacts. Blasting may affect geology causing more difficult access to mineral or petroleum resources, local faulting or slumping, or development of sinkholes in karst topographic areas. The magnitude and extent of possible geologic impacts in the ICBM deployment areas would influence long-term productivity as it relates to geologic resources.

- Any additional information gained on archaeological, historic, architectural, and paleontological resources during the course of implementing the proposed action would improve man's knowledge of the area's history and enhance the management of remaining cultural resources. Long-term productivity associated with cultural resources information could benefit from actions conducted to implement the Treaty.

- Possible construction of new facilities for storage, conversion, or elimination would result in a long-term visual intrusion into previously undisturbed visual landscapes.

- Short-term disturbances of previously undisturbed biological habitats from the possible construction of new storage or elimination facilities would cause long-term reductions in the biological productivity of an area. These long-term reductions would primarily occur at facilities located in the arid areas of the western United States (e.g. Davis-Monthan AFB, Tooele Army Depot, Pueblo Army Depot Activity) where biological communities recover very slowly from disturbance.

- Short-term truck traffic to, from, and within the deployment areas and posibly at the storage, conversion, or elimination facilities would result in some degradation of roads which would cause a long-term decrease in comfort, convenience, and safety for local users. However, the gravel roads within the deployment area would be regraded after the completion of the deactivation process. A decrease in funding for road maintenance would result in a gradual deterioration of the road system.

- A reduced level of operations at the deployment bases following activities conducted to implement the Treaty would impact the socioeconomic environment of these areas. A short-term increase in employment associated with the deactivation process could be followed by a long-term decrease in economic productivity of these regions unless the affected bases receive new mission assignments.

## 4.15 IMPACTS OF THE NO ACTION ALTERNATIVE

As discussed in Section 2.3, the no action alternative (Treaty non-ratification) would constitute a continuation of the current activities of the US strategic forces. The execution of the national defense policy unencumbered by any Treaty restraints will result in environmental consequences caused by on-going and future DOD activities. These activities include continued operation and maintenance of existing weapon systems, modernization of weapon systems, retirement of some weapon systems, training and testing operations, and force structure and mission changes.

Prior EAs, EISs, and other technical documents have discussed the environmental conditions, impacts, and mitigations associated with many of DOD activities that were initiated after 1970. Because many of the operations and activities of strategic systems have been carried on since the 1950s, no comprehensive environmental impact analyses of these actions have been done, but impact assessments have been prepared for many changes in those actions and proposed programs, such as modernization, base realignments, and use of new training ranges.

Most of the actions addressed in those studies are underway. Other actions have been proposed, but the likelihood of their implementation is unknown. The various impacts predicted in those studies for actions that have been implemented are mostly now part of the existing conditions at the bases and maintenance facilities. Thus, the impacts of the no action alternative are essentially a continuation of existing environmental conditions and trends. These existing environmental conditions and trends of deployment bases and storage, conversion, and elimination facilities are discussed in Section 3.0. The impacts of the Treaty implementation activities discussed in Sections 4.1 through 4.14 are potential departures from these existing conditions and trends. Some of these impacts could occur whether or not the Treaty is ratified.

Because DOD activities cover a broad spectrum of events that take place at numerous locations throughout the United States, a generic description of impacts from the no-action alternative are presented below by resource category.

Air Quality: Continued mobile and stationary emissions, both hazardous and non-hazardous air pollutants, can be expected from aircraft, various weapon systems, support operations, and support facilities. Current Defense budget constraints may result in reduced DOD activities (e.g. bases being closed or scheduled for closure) and fewer subsequent emissions at some locations. Other locations may experience a potential emissions increase as a result of new mission assignments (e.g. bases scheduled for realignment or bases scheduled for new aircraft or weapon systems). DOD will continue to institute long-term control measures for particular pollutant emission sources in non-attainment areas. Recent amendments to the Clean Air Act will lead to new and revised State Implementation Plans (SIPs) aimed at preventing any significant increase in air

pollutants. DOD's ongoing and planned activities will be required to comply with the emission limits and guidelines for individual SIPs.

Noise: Continued noise emissions can be expected from aircraft, weapon systems maintenance, testing, and retirements, and DOD support operations associated with existing and planned missions. The AICUZ program, development of quantity distance zones in areas generating high noise levels, and other planned mitigation measures will continue to reduce potential noise impacts.

Water Resources: In absence of the proposed action, the potential for ground and surface water contamination will continue. This potential for contamination originates from pollutants being accidentally or unknowingly discharged into stormwater, sewage, and open drainage collection systems. Increased permitting and monitoring of discharges will continue to reduce the potential for ground and surface water contamination at DOD facilities. Most DOD facilities are actively involved in groundwater testing and clean-up operations to remediate environmental damage caused by mistakes of the past. New regulations pertaining to the construction of jet fuel storage and transfer facilities will reduce the possibility of spills entering ground and surface waters. Actual water consumption at DOD facilities will likely decline because of current plans for personnel reductions. Many facilities in the Southwest from Texas to California have developed drought management plans designed to conserve water resources. Overall, water quality is expected to improve and consumption decrease for the No Action Alternative.

Geology/Soils: For the No Action Alternative, the potential for soil contamination from herbicide use, fuel and hazardous waste spills, and deposition of air pollutants will continue. Improved environmental management practices, extensive clean-up operations of contaminated soils, and large scale UST removal and replacement will likely result in improved soil quality at DOD facilities. Construction of any new facilities would result in some erosion and destruction of soil cover. Geologic conditions will likely be unaffected for the No Action Alternative.

Cultural Resources: Because such resources are nonrenewable, further activities under the No Action Alternative, like those of the past, would cause losses of these resources from military testing and training, construction, agricultural and mining development, vandalism and looting, and natural erosion. These general trends can be expected at almost any location. However, the overall reduction in personnel and level of operations at defense facilities due to the reduced U.S. defense budget will lessen the potential for damages to cultural resources.

Visual Resources: For the No Action Alternative, the existing visual settings will remain essentially unchanged.

Transportation: The roadway LOS for those areas experiencing regional growth will decline unless highway upgrades and other traffic improvements are implemented. Fewer

base personnel, the result of DOD manpower reductions, could result in improved LOS at many locations. Those facilities scheduled for realignment and an increase in personnel will experience additional adverse traffic impacts. Many facilities have developed traffic management plans designed to facilitate flow and reduce parking problems, accidents, and vehicle emissions.

Biological Resources: Present activities, policies, and trends under the No Action Alternative will continue to have impacts to biological resources. New and continuing projects, missions, and associated construction at various facilities can be expected to disrupt biological habitat and otherwise disturb flora and fauna. Activities occurring or planned at facilities that destroy habitat and kill and disturb biota include off-road tests of military vehicles, troop training and maneuvers, impact of artillery fire and ballistic missiles, and air-to-ground firing and bombing. Low-altitude flying of military aircraft in low-level training routes startle and disrupt daily activities of wildlife. DOD is currently working to minimize impacts to biota through restoration of habitats, setting aside AF lands for wildlife and threatened and endangered species management areas, and other site-specific mitigation measures. DOD's positive environmental ethic has benefitted biological resources. On October 13, 1989 DOD reaffirmed its commitment to wetlands protection by establishing a goal of "no net loss" of wetlands on its properties. DOD is working with EPA to restore and protect the natural state of Chesapeake Bay. DOD is managing its resources with considerable assistance and cooperation from the US Forest Service, the Soil Conservation Service, the Fish and Wildlife Service, the states, and private conservation groups. Recent management activities include enhancing waterfowl habitat at DOD installations, working with the Nature Conservancy to enhance management of rare species on DOD lands, and participation in the EPA and US Department of Agriculture efforts to study forestry practices that can alleviate global warming and promote energy conservation.

Human Health and Safety: Potential risks to human health and safety originating from military operations at the deployment bases and storage, conversion, and elimination facilities will continue. These risks at DOD facilities are primarily from noise emissions, air pollutants, hazardous materials handling, hazardous waste generation and disposal activities, and transportation and training exercise accidents. Currently the health and safety of military and civilian personnel and ultimately the general public are safeguarded by numerous DOD directives and department specific regulations designed to comply with OSHA and EPA standards. Additionally RCRA and CERCLA impose specific requirements pertaining to health and safety issues. For the No Action Alternative, facilities will continue to follow and improve their hazardous waste management and minimization plans. On-going hazardous waste/hazardous materials minimization programs will benefit those susceptible to possible exposure to these substances, reduce DOD liability, and lessen the potential for environmental damage.

Socioeconomics: For the No Action Alternative, the socioeconomic environment is dependent on U.S. defense policy and defense budget. The recent declines in defense

expenditures will create changes in military missions, base realignments, and weapon systems planning. Thus, the potential for force structure changes, realignments, and base closures and the associated employment fluctuations will continue at the deployment bases. Current population and employment trends discussed in Section 3.10 will most likely continue.

Table 2-5 (Section 2.3) summarizes the environmental consequences discussed above and those of the proposed action. This summary serves as a basis for comparing the potential impacts of each action.

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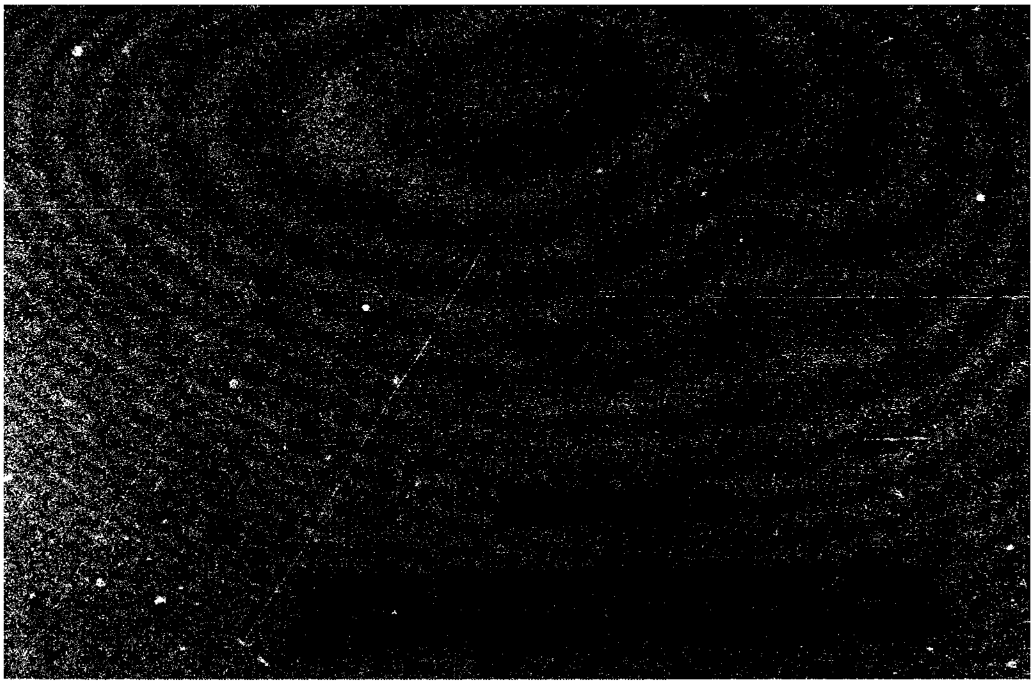

| Table B-1<br>Model Results for Static Fire of Minuteman II Stage I Rocket Motor<br>Under Stability Class A Conditions and 7.0 M/Sec Windspeed | | | | | |
|---|---|---|---|---|---|
| | | PCAD Results | | ISCST Results | |
| Emission Products | Maximum Concentration ($\mu g/m^3$) | 1 Hour Average Concentration ($\mu g/m^3$) | 24 Hour Average Concentration ($\mu g/m^3$) | 1 Hour Average Concentration ($\mu g/m^3$) | 24 Hour Average Concentration ($\mu g/m^3$) |
| $AL_2O_3$ | 1,400 | 24 | 1.0 | 46 | 1.9 |
| CO | 25 | 0.4 | <0.1 | 1.0 | <0.1 |
| HCl | 830 | 14 | 0.6 | 27 | 1.1 |
| NO[a] | 190 | 0.3 | <0.1 | 0.6 | 0.2 |

Maximum concentration occurs at 6.4 km downwind
Plume height = 1,544 m

[a] NO is reported rather than $NO_x$ (equivalent to NO + $NO_2$) because the $NO_2$ concentrations are approximately 0.1% that of NO. This proportion is insignificant in comparison to the sensitivity of the computer models.

| Table B-2<br>Model Results for Static Fire of Minuteman II Stage I Rocket Motor<br>Under Stability Class A Conditions and 2.0 M/Sec Windspeed | | | | | |
|---|---|---|---|---|---|
| | | PCAD Results | | ISCST Results | |
| Emission Products | Maximum Concentration ($\mu g/m^3$) | 1 Hour Average Concentration ($\mu g/m^3$) | 24 Hour Average Concentration ($\mu g/m^3$) | 1 Hour Average Concentration ($\mu g/m^3$) | 24 Hour Average Concentration ($\mu g/m^3$) |
| $AL_2O_3$ | 4,800 | 81 | 3.4 | 160 | 6.6 |
| CO | 84 | 1.4 | <0.1 | 2.8 | 0.1 |
| HCl | 2,800 | 48 | 2.0 | 93 | 3.9 |
| NO[a] | 63 | 11 | 0.4 | 21 | 0.9 |

Maximum concentration occurs at 6.6 km downwind
Plume height = 1,568 m

[a] NO is reported rather than $NO_x$ (equivalent to NO + $NO_2$) because the $NO_2$ concentrations are approximately 0.1% that of NO. This proportion is insignificant in comparison to the sensitivity of the computer models.

| Table B-3<br>Model Results for Static Fire of Minuteman II Stage I Rocket Motor<br>Under Stability Class B Conditions and 10.0 M/Sec Windspeed | | | | | |
|---|---|---|---|---|---|
| | | PCAD Results | | ISCST Results | |
| Emission Products | Maximum Concentration (μg/m³) | 1 Hour Average Concentration (μg/m³) | 24 Hour Average Concentration (μg/m³) | 1 Hour Average Concentration (μg/m³) | 24 Hour Average Concentration (μg/m³) |
| $AL_2O_3$ | 1,100 | 19 | 0.8 | 18 | 0.7 |
| CO | 20 | 0.3 | <0.1 | 0.3 | <0.1 |
| HCl | 670 | 11 | 0.5 | 10 | 0.4 |
| NO[a] | 150 | 2.5 | 0.1 | 2.3 | 0.1 |

*Maximum concentration* occurs at 9.0 km downwind
Plume height = 1,370 m

[a] NO is reported rather than $NO_x$ (equivalent to NO + $NO_2$) because the $NO_2$ concentrations are approximately 0.1% that of NO. This proportion is insignificant in comparison to the sensitivity of the computer models.

| Table B-4<br>Model Results for Static Fire of Minuteman II Stage I Rocket Motor<br>Under Stability Class B Conditions and 3.0 M/Sec Windspeed | | | | | |
|---|---|---|---|---|---|
| | | PCAD Results | | ISCST Results | |
| Emission Products | Maximum Concentration (μg/m³) | 1 Hour Average Concentration (μg/m³) | 24 Hour Average Concentration (μg/m³) | 1 Hour Average Concentration (μg/m³) | 24 Hour Average Concentration (μg/m³) |
| $AL_2O_3$ | 6,000 | 100 | 4.2 | 91 | 3.8 |
| CO | 100 | 1.7 | <0.1 | 1.6 | 0.1 |
| HCl | 3,500 | 59 | 2.4 | 53 | 2.2 |
| NO[a] | 780 | 13 | 0.5 | 12 | 0.5 |

Maximum concentration occurs at 7.2 km downwind
Plume height = 1,083 m

[a] NO is reported rather than $NO_x$ (equivalent to NO + $NO_2$) because the $NO_2$ concentrations are approximately 0.1% that of NO. This proportion is insignificant in comparison to the sensitivity of the computer models.

**Table B-5**
**Model Results for Static Fire of Minuteman II Stage I Rocket Motor Under Stability Class C Conditions and 10.0 M/Sec Windspeed**

| | | PCAD Results | | ISCST Results[b] | |
|---|---|---|---|---|---|
| **Emission Products** | **Maximum Concentration (μg/m³)** | **1 Hour Average Concentration (μg/m³)** | **24 Hour Average Concentration (μg/m³)** | **1 Hour Average Concentration (μg/m³)** | **24 Hour Average Concentration (μg/m³)** |
| $AL_2O_3$ | 1,200 | 20 | 0.8 | 9.4 | 0.4 |
| CO | 21 | 0.4 | <0.1 | 0.2 | <0.1 |
| HCl | 700 | 12 | 0.5 | 5.5 | 0.2 |
| NO[a] | 160 | 2.6 | 0.1 | 1.2 | 0.1 |

Maximum concentration occurs at 13.2 km downwind
Plume height = 1,370 m

[a] NO is reported rather than $NO_x$ (equivalent to NO + $NO_2$) because the $NO_2$ concentrations are approximately 0.1% that of NO. This proportion is insignificant in comparison to the sensitivity of the computer models.
[b] Maximum concentration was beyond the range (20 km) of ISCST used in this scenario.

**Table B-6**
**Model Results for Static Fire of Minuteman II Stage I Rocket Motor Under Stability Class A Conditions and 2.0 M/Sec Windspeed**

| | | PCAD Results | | ISCST Results[b] | |
|---|---|---|---|---|---|
| **Emission Products** | **Maximum Concentration (μg/m³)** | **1 Hour Average Concentration (μg/m³)** | **24 Hour Average Concentration (μg/m³)** | **1 Hour Average Concentration (μg/m³)** | **24 Hour Average Concentration (μg/m³)** |
| $AL_2O_3$ | 1,100 | 18 | 0.8 | 0.8 | <0.1 |
| CO | 19 | 0.3 | <0.1 | <0.1 | <0.1 |
| HCl | 640 | 11 | 0.5 | 0.5 | <0.1 |
| NO[a] | 140 | 2.4 | 0.1 | 0.1 | <0.1 |

Maximum concentration occurs at 20.4 km downwind
Plume height = 1,288 m

[a] NO is reported rather than $NO_x$ (equivalent to NO + $NO_2$) because the $NO_2$ concentrations are approximately 0.1% that of NO. This proportion is insignificant in comparison to the sensitivity of the computer models.
[b] Maximum concentration was beyond the range (20 km) of ISCST used in this scenario.

**Table B-7**
**Model Results for Static Fire of Minuteman II Stage 3 Rocket Motor Under Stability Class A Conditions and 7.0 M/Sec Windspeed**

| | | PCAD Results | | ISCST Results | |
|---|---|---|---|---|---|
| Emission Products | Maximum Concentration (μg/m³) | 1 Hour Average Concentration (μg/m³) | 24 Hour Average Concentration (μg/m³) | 1 Hour Average Concentration (μg/m³) | 24 Hour Average Concentration (μg/m³) |
| $AL_2O_3$ | 720 | 11 | 0.5 | 21 | 0.9 |
| CO | 28 | 0.4 | <0.1 | 0.8 | <0.1 |
| HCl | 86 | 1.4 | 0.1 | 2.5 | 0.1 |
| NO[a] | 88 | 1.4 | 3.4 | 2.6 | 0.1 |

Maximum concentration occurs at 3.0 km downwind
Plume height = 702 m

(a) NO is reported rather than $NO_x$ (equivalent to NO + $NO_2$) because the $NO_2$ concentrations are approximately 0.1% that of NO. This proportion is insignificant in comparison to the sensitivity of the computer models.

**Table B-8**
**Model Results for Static Fire of Minuteman II Stage 3 Rocket Motor Under Stability Class A Conditions and 2.0 M/Sec Windspeed**

| | | PCAD Results | | ISCST Results | |
|---|---|---|---|---|---|
| Emission Products | Maximum Concentration (μg/m³) | 1 Hour Average Concentration (μg/m³) | 24 Hour Average Concentration (μg/m³) | 1 Hour Average Concentration (μg/m³) | 24 Hour Average Concentration (μg/m³) |
| $AL_2O_3$ | 2,400 | 39 | 1.6 | 71 | 2.9 |
| CO | 95 | 1.5 | 0.1 | 2.7 | 0.1 |
| HCl | 290 | 4.6 | 0.2 | 8.5 | 0.4 |
| NO[a] | 300 | 4.8 | 0.2 | 8.7 | 0.4 |

Maximum concentration occurs at 3.0 km downwind
Plume height = 713 m

(a) NO is reported rather than $NO_x$ (equivalent to NO + $NO_2$) because the $NO_2$ concentrations are approximately 0.1% that of NO. This proportion is insignificant in comparison to the sensitivity of the computer models.

**Table B-9**
**Model Results for Static Fire of Minuteman II Stage 3 Rocket Motor Under Stability Class B Conditions and 10.0 M/Sec Windspeed**

| | | PCAD Results | | ISCST Results | |
|---|---|---|---|---|---|
| Emission Products | Maximum Concentration (μg/m³) | 1 Hour Average Concentration (μg/m³) | 24 Hour Average Concentration (μg/m³) | 1 Hour Average Concentration (μg/m³) | 24 Hour Average Concentration (μg/m³) |
| $AL_2O_3$ | 580 | 9.2 | 0.4 | 9.0 | 0.4 |
| CO | 22 | 0.4 | <0.1 | 0.3 | <0.1 |
| HCl | 69 | 1.1 | <0.1 | 1.1 | <0.1 |
| NO[a] | 71 | 111 | <0.1 | 1.1 | <0.1 |

Maximum concentration occurs at 4.2 km downwind
Plume height = 623 m

[a] NO is reported rather than $NO_x$ (equivalent to NO + $NO_2$) because the $NO_2$ concentrations are approximately 0.1% that of NO. This proportion is insignificant in comparison to the sensitivity of the computer models.

**Table B-10**
**Model Results for Static Fire of Minuteman II Stage 3 Rocket Motor Under Stability Class A Conditions and 3.0 M/Sec Windspeed**

| | | PCAD Results | | ISCST Results | |
|---|---|---|---|---|---|
| Emission Products | Maximum Concentration (μg/m³) | 1 Hour Average Concentration (μg/m³) | 24 Hour Average Concentration (μg/m³) | 1 Hour Average Concentration (μg/m³) | 24 Hour Average Concentration (μg/m³) |
| $AL_2O_3$ | 3,000 | 48 | 2.0 | 47 | 2.0 |
| CO | 120 | 1.9 | 0.1 | 1.8 | 0.1 |
| HCl | 360 | 5.7 | 0.2 | 5.6 | 0.2 |
| NO[a] | 370 | 5.9 | 0.2 | 5.8 | 0.2 |

Maximum concentration occurs at 3.2 km downwind
Plume height = 492 m

[a] NO is reported rather than $NO_x$ (equivalent to NO + $NO_2$) because the $NO_2$ concentrations are approximately 0.1% that of NO. This proportion is insignificant in comparison to the sensitivity of the computer models.

| Table B-11<br>Model Results for Static Fire of Minuteman II Stage 3 Rocket Motor<br>Under Stability Class C Conditions and 10.0 M/Sec Windspeed | | | | | |
|---|---|---|---|---|---|
| | | PCAD Results | | ISCST Results | |
| Emission Products | Maximum Concentration ($\mu g/m^3$) | 1 Hour Average Concentration ($\mu g/m^3$) | 24 Hour Average Concentration ($\mu g/m^3$) | 1 Hour Average Concentration ($\mu g/m^3$) | 24 Hour Average Concentration ($\mu g/m^3$) |
| $AL_2O_3$ | 600 | 9.6 | 0.4 | 5.5 | 0.2 |
| CO | 24 | 0.4 | <0.1 | 0.2 | <0.1 |
| HCl | 73 | 1.2 | <0.1 | 0.7 | <0.1 |
| NO[a] | 75 | 1.2 | <0.1 | 0.7 | <0.1 |

Maximum concentration occurs at 6.0 km downwind
Plume height = 623 m

(a) NO is reported rather than $NO_x$ (equivalent to NO + $NO_2$) because the $NO_2$ concentrations are approximately 0.1% that of NO. This proportion is insignificant in comparison to the sensitivity of the computer models.

| Table B-12<br>Model Results for Static Fire of Minuteman II Stage 3 Rocket Motor<br>Under Stability Class D Conditions and 12.0 M/Sec Windspeed | | | | | |
|---|---|---|---|---|---|
| | | PCAD Results | | ISCST Results | |
| Emission Products | Maximum Concentration ($\mu g/m^3$) | 1 Hour Average Concentration ($\mu g/m^3$) | 24 Hour Average Concentration ($\mu g/m^3$) | 1 Hour Average Concentration ($\mu g/m^3$) | 24 Hour Average Concentration ($\mu g/m^3$) |
| $AL_2O_3$ | 560 | 8.8 | 0.4 | 0.9 | <0.1 |
| CO | 22 | 0.3 | <0.1 | <0.1 | <0.1 |
| HCl | 67 | 1.1 | <0.1 | 0.1 | <0.1 |
| NO[a] | 68 | 1.1 | <0.1 | 0.1 | <0.1 |

Maximum concentration occurs at 9.2 km downwind
Plume height = 585 m

(a) NO is reported rather than $NO_x$ (equivalent to NO + $NO_2$) because the $NO_2$ concentrations are approximately 0.1% that of NO. This proportion is insignificant in comparison to the sensitivity of the computer models.

## GLOSSARY

A-Weighted Sound Level (dBA). A single number measure of a noise event. A-weighted sound pressure level is a sound pressure level which has been filtered or weighted to reduce the influence of the low and high frequency extremes in order to correlate better with human assessment of the loudness of sound.

Active Fault. A fault on which movement has occurred during the past 10,000 years and which may be subject to recurring movement, usually indicated by small, periodic displacement or seismic activity.

Advisory Council on Historic Preservation. A ninteen-member body appointed, in part, by the President of the United States to advise the President and Congress and to coordinate the actions of federal agencies on matters relating to historic preservation to comment on the effects of such actions as required by law (Public Law 89-655; 16 USC 470).

Air Installation Compatible Use Zone. A concept developed by the Air Force to promote land use development near its airfields in a manner that protects adjacent communities from noise and safety hazards associated with aircraft operation and to preserve the operational integrity of the airfields.

Air Quality Control Region. An area, designated by Section 107 of the Clean Air Act which is based on jurisdictional boundaries, urban-industrial concentrations, and other factors including atmospheric areas, that is necessary to provide adequate implementation of air quality standards.

Ambient Air Quality Standards. Standards established on a state or federal level that define the limits for airborne concentrations of designated "criteria" pollutants (e.g., nitrogen dioxide, sulfur dioxide, carbon monoxide, total suspended particulates, ozone, lead, and hydrocarbons) to protect public health with an adequate margin of safety (primary standards) and to protect public welfare, including plant and animal life, visibility, and materials (secondary standards).

Ambient. Encompassing on all sides.

Annual Average Weekday Traffic. Denotes that the specified period includes only weekdays, Monday through Friday.

Aquifer. The water-bearing portion of subsurface earth material that yields or is capable of yielding useful quantities of water to wells.

Archaeology. A scientific approach to the study of human ecology, cultural history, and cultural process, emphasizing systematic interpretation of material remains.

Atmosphere. A region of gases and particulate matter extending above the Earth's surface.

Atmospheric Dispersion. The transport and mixing of gases or suspended particles in the atmosphere by winds and turbulent processes.

Attainment Area. An area that has been designated by the U.S. Environmental Protection Agency and the appropriate stage air quality agency as having ambient air quality levels below the ceiling levels defined under the National Ambient Air Quality Standards.

Attenuation. To reduce in level. Generally, noise attenuates at a rate of 6 dB for each doubling of distance from the source.

Average Annual Daily Traffic. For a one-year period, the total volume passing a point or segment of a highway facility in both directions, divided by the number of days in the year.

Baseline. The existing and future-growth characterization of an area without the proposed program.

Basin. A drainage or catchment area of a stream or lake.

Bedrock. Geologic formation or unit which underlies soil or other unconsolidated surficial deposits.

Biological Diversity. Refers to the number of species and their relative abundance in an area or habitat.

Biome. Major regional ecological community of plants and animals extending over large natural areas.

Cairn. A distinctly artificial pile of rocks that may mark or enclose burials, vision quests, caches, or geodetic locales.

Capacity. (Transportation). The traffic-carrying ability of a facility while maintaining prescribed operational qualities (e.g., a specific level of service); the maximum amount of traffic that can be accommodated by a given facility. (Note: Traffic facilities generally operate poorly at or near capacity, and facilities are rarely designed or planned to operate within this range.)

Capital Costs. Expenditures by local governments on physical infrastructure.

**Carcinogen**. A chemical or form of radiation (energy) that directly or indirectly causes a form of cancer.

**Climate**. The prevalent or characteristic meteorological conditions (and their extremes) of any given location or region.

**Community**. In biology, an assemblage of species in a particular place.

**Compound**. Substance composed of atoms or ions of two or more different elements held together in a fixed ratio by chemical bonds.

**Cultural Resource**. Any building, site, district, structure, object, data, or other material significant in history, architecture, archaeology, or culture.

**Culture**. In general, the system of behavior, beliefs, institutions, and objects human beings use to relate to each other and to the environment.

**Cumulative Impacts**. Impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Effects resulting from individually minor but collectively significant actions taking place over a period of time.

**Decibel Scale**. A logarithmic measure of audible sound pressure levels dimensioned in decibel units. The hearing threshold of 20 u PA is the starting point, or zero on the decibel scale. One million times the hearing threshold level of 120 dB equates to the approximate threshold of pain.

**Decibel**. The unit of measurement of sound level calculated by taking ten times the common logarithm of the ratio of the magnitude of the particular sound pressure to the standard reference sound pressure of 20 micropascals and its derivatives.

**Decommissioning**. The process of removing a weapon system from service.

**Deployment Area**. Geographic region where weapon systems are located.

**Deployment**. Strategic emplacement of a weapon system.

**Drawdown**. The distance between the static water level and the temporarily depressed water level caused by well pumpage.

**Endangered Species**. A species that is threatened with extinction throughout all or a significant portion of its range.

**Energy**. The capacity for doing work; taking a number of forms which may be transformed from one into another, such as thermal (heat mechanical work), electrical, and chemical; in customary units, measured in kilowatt hours (kWh) or British thermal units (BTU).

**Environment**. The sum total or the resultant of all the external conditions which act upon an organism.

**Furbearers**. Mammal species which are harvested by trappers - such as muskrat, raccoon, or beaver.

**Ephemeral Stream**. Drainage that flows briefly only in response to precipitation in the immediate vicinity and whose channel is above the water table at all times.

**Equivalent Sound Level**. The level of a constant sound which, in a given situation and time period, has the same sound energy as does a time-varying sound. Technically, equivalent sound level is the level of the time-weighted, mean square, A-weighted sound pressure. The time interval that the measurement is taken should always be specified.

**Expenditure**. A disbursement of funds by a government entity; includes operation and maintenance costs, as well as capital costs.

**Fauna**. Animals; organisms of the animal kingdom of a given area taken collectively.

**Federal-candidate Species**. Taxa placed in Federal Categories 1 and 2 by the U.S. Fish and Wildlife Service, which are candidates for possible addition to the List of Endangered and Threatened Species.

**Floodplain**. The surface of relatively smooth land adjacent to a river channel that is covered by water when the river overflows.

**Frequency**. The number of repetitions per unit time of a periodic wave form, as of radio waves or sound waves, measured in Hertz.

**Fugitive dust**. Particulate matter composed of soil which is uncontaminated by pollutants resulting from industrial activity. Fugitive dust may include emissions from haul roads, wind erosion of exposed soil surfaces, and other activities in which soil is either removed or redistributed.

**Groundwater**. Subsurface water contained in the saturation zone of the soil where all the pore spaces or voids are filled with water.

**Habitat**. A place where particular plants or animals occur or could occur.

**Hard Silo**. A buried structure that will be used to protect small intercontinental ballistic missiles; similar to existing missile silos but more resistant to damage.

**Hazardous Substances**. Solid or liquid materials which may cause or contribute to mortality or serious illness by virtue of physical and chemical characteristics, or pose a hazard to human health or the environment when improperly managed, disposed of, treated, stored, or transported.

**Hazardous Waste**. A waste, or combination of wastes, which, because of its quantity, concentration, or physical, chemical, or infectious characteristics, may either cause, or significantly contribute to an increase in mortality or an increase in serious, irreversible illness; or pose a substantial present or potential hazard to human health or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

**Herpetofauna**. Amphibians (e.g., frogs and salamanders) and reptiles (e.g., lizards, snakes, and turtles).

**Hydrology**. The science dealing with the properties, description, and circulation of water on the surface of the land and in the soil and underlying rocks.

**Intercontinental Ballistic Missile**. A large missile capable of accurate weapon delivery over intercontinental ranges (usually greater than 5,000 miles).

**Interstate**. The designated National System of Interstate and Defense Highways located in both rural and urban areas; they connect the East and West coasts and extend from Canadian border points to various points on the Mexican border.

**Inversion**. A reversal of the normal atmospheric temperature gradient causing increasing temperatures with height.

**Karst**. A type of topography that is formed over limestone [calcium carbonate, $CaCO_3$], dolomite [calcium magnesium carbonate, $CaMg(CO_3)_2$], or gypsum [hydrous calcium sulfate, $CaSO_4 \cdot 2H_2O$] by dissolution, and that is characterized by sinkholes, caves, and underground drainage.

**Landfill**. A facility for land disposal of waste, regulated and managed to ensure that there is no reasonable probability of adverse effects to health or the environment.

**Ldn noise level**. The 24-hour average-energy sound level expressed in decibels, with a 10-decibel penalty added to sound levels between 10:00 p.m. and 7:00 a.m.

**Leachate**. A substance transported out of the soil in solution.

**Leq noise level**. A constant amount of acoustic energy equivalent to the energy contained in the time-varying noise measured from a given source for a given time.

**Level of Service**. In transportation analyses, a qualitative measure describing operational conditions within a traffic stream and how they are perceived by motorists and/or passengers.

**Liquefaction**. The transformation of unconsolidated sediment into a fluid form resulting from a loss of strength associated with seismic vibrations.

**Lithic Scatter**. An archaeological site consisting only of stone artifacts.

**Loam**. A rich, permeable soil composed of equal amounts of clay, silt, and sand, usually containing organic matter.

**Long Duration**. Impacts that would occur over an extended period of time. Most impacts from the operations phase are expected to be of long duration since program operations essentially represent a steady-state condition (i.e., impacts resulting from actions that occur repeatedly over a long period of time). However, long-duration impacts could also be caused by construction activities if a resource is destroyed or irreparably damaged or if the recovery rate of the resource is very slow.

**Long Term**. A long-duration effect.

**Microgram**. One-millionth of a gram.

**Mineral**. Either a chemical element or chemical compound (combination of elements) in solid form.

**Mitigation**. A method or action to reduce or eliminate program impacts.

**Model**. A mathematical formula that expresses the actions and interactions of the elements of a system in such a manner that the system may be evaluated under any given set of conditions; i.e., groundwater, erosion, sedimentation, and water quality.

**Module**. A grouping of adjacent silos.

**Multiplier**. In economics, used to determine the indirect and induced effects (in terms of increased employment, income, or output) resulting from program activities.

**National Register of Historic Places**. A register of districts, sites, buildings, structures, and objects important in American history, architecture, archaeology, and culture, maintained by the Secretary of the Interior under authority of Section 2(b) of the Historic

Sites Act of 1935 and Section 101(a)(1) of the National Historic Preservation Act of 1966, as amended.

Native Americans. Used in a collective sense to refer to natives of aboriginal North America.

Native Vegetation. Plant life that occurs naturally in an area without agricultural or cultivation efforts.

Noise Contour. A curved line connecting places on a map representing a line of equal noise exposure. Noise exposure is commonly expressed using the average day-night sound level, LDN, expressed in decibels.

Noise Sensitive Areas. Specific locations (or general areas) of types of land use activities that may be affected by noise sources (i.e. traffic, construction, and/or explosive activity).

Noise. Sound that is perceived by humans to be annoying and unwanted.

Nonattainment Area. An area that has been designated by the U.S. Environmental Protection Agency and the appropriate state air quality agency as exceeding one or more National Ambient Air Quality Standards.

Nonrenewable Recharge. A resource that is not replaced by natural processes or for which the rate of replacement is slower than its rate of use.

Net Recharge. A condition in which groundwater withdrawals exceed the amount of recharge.

Paleontological Resources. Fossilized organic remains from past geological periods.

Particulate. Minute solid material.

Polychlorinated Biphenyls (PCBs). A synthetic organic material used as an insulating material in some electronic components such as transformers and known to be a human carcinogen or cancer-causing agent.

Per Capita Personal Income. Average annual income per person (in a specified region).

Perennial Stream. A stream that has continuous flow during all periods of the year.

Personal Income. Total annual income earned by individuals before taxes including interest income, transfer payments, and employee fringe benefits.

**Physiographic Province**. A region with similar parts in geologic structure and climate that have a unified geomorphic history.

**Physiography**. A description of the surface features of the earth.

**Plume Rise**. The elevation a plume rises following emission from a source, which is dependent upon ambient air temperature, height of the mixing layer, and plume temperature and density.

**Plume**. The theoretical cloud of pollutant emitted from a source (e.g., stack exhaust pipe).

**Prehistoric**. The period of time prior to the written record, generally before B.C. 1800.

**Prevention of Significant Deterioration Area**. A requirement of the Clean Air Act (160 et seq) that limits the increases in ambient air pollutant concentrations in clean air areas to certain increments, even though ambient air quality standards are met.

**Pristine Areas**. An air quality region with background air quality levels representative of a Class I airshed.

**PSD Class I Areas**. Lands in which existing air quality is to be most stringently maintained.

**Queue Length**. Length of vehicles backed up at a signalized intersection during the red light.

**Rangeland**. Land devoted to the maintenance (grazing and keeping) of animals (e.g., cattle, sheep, and horses).

**Raptors**. Birds of prey, such as hawks, eagles, and owls.

**Reclamation**. The process of restoration of an area that has been disturbed, or the treatment to restore continued utility of a waste substance.

**Renewable Resource**. A resource that potentially cannot be used up because it is constantly or cyclically replenished. Either it comes from an essentially inexhaustible source (such as solar energy), or it can be renewed by natural or human-devised cyclical processes if it is not used faster than it is renewed.

**Resource (natural)**. Any form of matter or energy obtained from the environment that meets human needs.

**Revegetation**. Regrowth or replacement of a plant community on a disturbed site.

Riparian. Of or relating to land lying immediately adjacent to a water body, and having specific characteristics of the transitional area (e.g., riparian vegetation).

Riprap. Broken rock, cobble, or boulders placed on earth surfaces to retard water erosion.

Runoff. The non-infiltrating water entering a stream or other conveyance channel shortly after a rainfall.

Rural Area. The area outside towns, cities, or communities that is characterized by very low-density housing concentrations, agricultural land uses, and a general lack of most public services.

Scrubber. Common antipollution device that uses a liquid spray to remove pollutants from a stream of air.

Sediment. Particles derived from rock or biological sources that have been transported by water.

Seismic. Pertains to the characteristics of an earthquake or earth vibrations, including those that are artificially induced.

Sensitive Receptor. Areas defined as sensitive to noise, such as hospitals, residential areas, schools, outdoor theaters, etc., and protected wildlife species.

Sheet Erosion. Erosion caused by a layer of water moving downward on a surface that has not yet developed channels, rills, or gullies. Uneven sheet erosion leads to the formation of rills and, eventually, gullies.

Short Duration. Transitory effects of the proposed program that are of limited duration and are generally caused by construction activities or operations start-up.

Significance. The importance of a given impact on a specific resource as defined under the Council on Environmental Quality regulations.

Site-specific. Conditions characteristic of a geographically defined location that may vary considerably from characteristics of adjacent locations or the characteristics of a larger area within which the location in question is contained.

Site. Any location where humans have altered the terrain or discarded artifacts.

Sound Exposure Level. The level of sound accumulated over a given time period or event. It is particularly appropriate for a discrete event such as the passage of an airplane, a railroad train, or a truck. Sound exposure level is not an average, but a kind

of sum. In contrast with average sound level, which may tend to stay relatively constant even though the sound fluctuates, sound exposure level increases continuously with the passing of time. Technically, sound exposure level in decibels is the level of the time integral of A-weighted squared sound pressure over a stated time interval or event, with reference to the square of the standard reference pressure of 20 micropascals (0.0002 microbar) and reference duration of one second.

__Sound Level__. The quantity in decibels measured by a sound level meter satisfying the requirements of American National Standards specification for Sound Level Meters. Sound level is the frequency-weighted, sound pressure level obtained with the standardized, dynamic characteristic "fast" or "slow" and weighting A, B, or C; unless otherwise indicated, the A-weighted is understood. The unit of any sound level is the decibel, which has the unit symbol Db.

__Species__. All organisms of a given kind; a group of plants or animals that breed or are bred together but are not bred successfully with organisms outside their group.

__State Historic Preservation Officer__. The official within each state, authorized by the state at the request of the Secretary of the Interior, to act as liaison for purposes of implementing the National Historic Preservation Act.

__State-sensitive/State-recognized Species__. Plant and wildlife species in each state that are monitored and listed for purposes of protection.

__Subsidence__. The sudden sinking or gradual downward settling of the Earth's surface with little or no horizontal motion.

__Tectonic__. Dealing with the regional assembling of structural or deformational features, and including a study of their mutual relations, origin, and historical evolution.

__Threatened Species__. A species that is likely to become endangered in the foreseeable future.

__Threshold Limit Value__. The maximum acceptable concentration for worker exposure to a potentially toxic material; determined on the basis of an eight-hour work day and forty-hour week.

__Threshold Pollutant__. Substance that is harmful to a particular organism only above a certain concentration, or threshold level.

__Tiering__. Technique of proceeding from general to specific analyses as a program evolves.

**Tepee Ring/Stone Circle**. A circle of stones generally measuring from 3.5 to 7 meters in diameter that is thought to represent the remains of various types of structures or to have served a religious or ceremonial function.

**Transporter/Erector**. A vehicle that transports a mobile launcher, conceals it during movement, and permits its undetected emplacement or removal at a protective structure.

**Turbidity**. The opaqueness (reduced clarity) of a fluid due to the presence of suspended matter.

**Ultraviolet**. Electromagnetic radiation with lower energy and longer wavelengths than X-rays, but higher energy and shorter wavelengths than visible light. Ultraviolet light has frequencies between $10^9$ and $10^{11}$ MHz.

**Unavoidable Adverse Impact**. A project-induced effect determined to be adverse that cannot, or will not, be mitigated or avoided.

**Unique and Sensitive Habitats**. Areas that are especially important to regional wildlife populations or protected species or which have other important biological characteristics (e.g., severe wintering habitats, nesting areas, and wetlands).

**Visibility Degradation**. Any adverse change in visibility consisting of either a reduction of visual range from some reference value, or a reduction in contrast between an object and the horizon sky, or a shift in coloration or light intensity of the sky or distant objects compared to that perceived on a "clear day."

**Volume**. (Transportation). the total number of vehicles that pass over a given point or section of a roadway during a given time interval. Volumes may be expressed in terms of annual, daily, hourly, or sub-hourly periods.

**Warhead**. The nuclear device contained within a reentry vehicle. Does not include the detonating mechanism and associated equipment.

**Water Table**. The upper surface of an unconfined body of groundwater.

**Wetlands**. Areas that are inundated or saturated with surface or groundwater at a frequency and duration sufficient to support a prevalence of vegetation typically adapted for life in saturated soil, including swamps, marshes, bogs, and similar areas.